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Community Formation in the Chulmun (Neolithic) and Mumun (Bronze Age) Periods of Korea

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Abstract

Despite its importance, exploring prehistoric community formation presents significant epistemological and methodological challenges. In Korean archaeology, these issues have rarely been addressed primarily due to the longstanding dominance of the culture-historical paradigm. However, extensive archaeological investigations and the accumulation of radiocarbon dates in recent decades have led to the gradual emergence of new research trends. This paper introduces and reviews recent studies on community formation during Korea's Chulmun (Neolithic) and the subsequent Mumun (Bronze Age) periods. While community and the village should not be equated, in order to archaeologically approach community formation, we examine the formation, growth, and dissolution of villages and their relationship with broader spatio-temporal population dynamics by analyzing a large radiocarbon dataset from Korea. We then discuss current conceptual and methodological issues related to the study of prehistoric community formation in Korea. Our discussion reveals the fluidity and flexibility of communities in the hunter-gatherer societies of the Chulmun period and the emergence of large villages and multilevel communities in the Mumun period following the transition to a sedentary agricultural economy and increasing social complexity. Finally, we highlight current research trends and future directions for the study of communities in prehistoric Korea.

Keywords Korea · Chulmun period · Mumun period · Village · Community · Population dynamics

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Introduction

Archaeology of the 21st century has transcended the conventional notion that prehistoric communities were static entities. It is now concurred that community is dynamic and constitutes a critical venue, not only physical but also ideological and conceptual, for human lives and interactions. But a consensus on its definition and, more significantly, how to approach community archaeologically remains elusive. Many of these challenges stem from the fuzziness of defining community. Perceptions of and involvement in a community vary among individuals and contexts, and the social roles of a community are in a state of constant flux. Multiple types and layers of communities coexist within a society on various scales and levels, and individuals participate in diverse communities across different contexts. Individuals may hold different notions of community depending on the contexts of their interactions—communities rooted in economic interactions may differ from those based on ideological or ritualistic interactions. Similarly, communities characterized by daily interactions may be distinct from those marked by sporadic interactions.

Although recent attention to community in archaeology (e.g., Birch 2014; Feinman and Neitzel 2023; Kolb and Snead 1997; Yaeger and Canuto 2012) marks an important achievement, the inherent fluidity and plurality of communities present numerous practical challenges. These issues were rarely recognized in earlier archaeological works, which often interpreted the physical village as equivalent to the socially dynamic community. Archaeologists no longer equate community, which "can take multiple and diverse forms" (Yaeger and Canuto 2012), solely with a village or residential cluster (Birch 2014; Yaeger and Canuto 2012), but they still are confronted with the dilemma of establishing links between material data and community and how to archaeologically recognize and investigate past communities. To address this issue, Kolb and Snead (1997) propose three archaeologically visible functions of community: social reproduction, subsistence production, and self-identification/social recognition. Yaeger and Canuto (2012) criticize these indices as overly functionalistic. They instead identify four methodological challenges in exploring past communities: correlating spatial and social units; addressing issues of scale and sampling; recognizing interaction patterns; and grappling with the question of palimpsests (Yaeger and Canuto 2012, p. 9). While these suggestions, despite their differing foci, can encompass various aspects of community, recognizing community from the archaeological data remains a difficult task. Among the above four challenges Yaeger and Canuto (2012) list, we suggest that correlating spatial and social units may be the most realistic starting point to archaeologically exploring communities, although the four challenges interwind in complicated ways. While, as stated above, the village and the community are distinct concepts, it may be suggested that the village plays a necessary role in archaeological understandings of communities. Villages, as spatial clusters of households, serve as hubs where multiple individuals engage with one another daily, irrespective of the nature of their interactions (Ortman and Coffey 2017). Villages can encompass individuals with diverse identities and

perceptions of community, while multiple villages interacting and sharing some degree of identity may collectively form a community. For example, large, aggregated communities may begin to impact smaller communities in their periphery, resulting in increased interactions between members of several communities. Although the reasons for aggregation may vary depending on context, it inevitably leads to altered forms of interaction, regardless of whether all members of a village community perceive themselves to belong to the same community. While a village cannot simply be equated with a community, we suggest that the village provides valuable insights into understanding community formation. Even though archaeological detection of village lifespan and the question of palimpsests remain problems that must be addressed, investigation of how villages formed and changed serves as a starting point for exploring community formation and change through time.

On exploring the relationship between the formation of village and community, Feinman and Neitzel's (2023) recent discussion deserves special consideration. Rather than attempting to directly bridge community to the archaeological record, they are more concerned with decisions made by individuals and households in given social contexts. They suggest that "individuals and households make choices about where to live and who to affiliate with based on opportunities and challenges" (Feinman and Neitzel 2023, p. 7). The choices made by decision-making units, which they call "affiliative decisions," involve "whether the advantages of staying with the larger cohort outweighed the costs of reconfigured social arrangements." While the affiliative decisions vary depending on many factors that affect the costs and benefits of staying in a particular place, Feinman and Neitzel (2023) emphasize the relationship between demography and interaction. According to them, if population increases or becomes closely packed over demographic thresholds and the size of the interactive network exceeds the capacity for information processing, new social institutions for adjustment may emerge, leading to substantial changes in the nature, range, and intensity of interactions among decision-making units (see also Ortman and Coffey 2017). Although the focus is not directly on the formation of community but the transition from mobile to sedentary lifeways, their model can be heuristically applied to understandings of the connection between the formation of village and community. Indeed, the formation and growth/decline of villages and ever-changing intra- and supra-village interactions are processes that are closely related to the spatio-temporal dynamics of demography. Demographic dynamics include not only changes in population but also the aggregation and/or dispersion of affiliative decision-making units that may facilitate new venues of interaction, leading to changes in various aspects of community.

In this paper, we undertake a review of archaeological works concerned with community formation during the Neolithic and Bronze Age periods of Korea, spanning 8000 to 100 BC. We aim to highlight major achievements and research trends in the prehistoric archaeology of Korea and delve into how community formation has been conceptualized in Korea and some of the epistemological and methodological issues that have arisen along with these conceptualizations. Over the past three decades, a wealth of archaeological data has been amassed in South Korea, making it one of the most extensively investigated regions in the world. Archaeologists in

South Korea have conducted thousands of excavations across large swathes of the southern Korean Peninsula largely due to surges in land development. The density of excavated sites in South Korea is among the highest globally, with more than 800 sites dated to the Neolithic and more than 3200 to the Bronze Age (Cultural Heritage Administration 2024; G.-A. Lee 2017), although very little is known about North Korea. While most investigations are rescue excavations, permission for excavations and the quality of investigations are systematically managed by government regulations.

Similar to other countries in northeast Asia, the archaeology of Korea has been dominated by a culture-historical approach based mainly on pottery typology (Choi et al. 2017; Yi 2022). Pottery typology serves as the primary means of establishing chronologies, defining "cultural groups," and tracing the origins of diffusion and migration. Diffusion and migration are typically employed as explanatory frameworks for changes in material culture, subsistence, and technology, although this paradigm has been continuously criticized (J. Kim 2014b; Seong et al. 2018). As large-scale rescue excavations in the 21st century revealed large numbers of settlement sites of various sizes across the southern half of the Korean Peninsula, settlement patterns began to be incorporated into archaeological research, albeit largely limited to descriptions of the spatial distribution of villages and hierarchical arrangements of sites according to their sizes, leaving the processes and causes of village development and community formation largely unexplored. However, as we review, some recent works have endeavored to elucidate the emergence and growth of villages during the Neolithic and Bronze Age and explore changes in the relationship between villages and communities, although much of this work has been published exclusively in Korean, limiting its exposure to the international community. These efforts owe much to the substantial accumulation of radiocarbon dates and their application toward understanding spatio-temporal population dynamics, a methodology that has been applied widely in other regions (e.g., Crema et al. 2017; Palmisano et al. 2017; Shennan 2018; Shennan et al. 2013; Timpson et al. 2014). Korea's radiocarbon database contains more than 17,000 dates, providing a comprehensive dataset for exploring population dynamics critical to understanding changes in population organization over time (Hwang 2021).

Contextualizing the Neolithic and Bronze Age of Korea in Northeast Asia

The prehistory of Korea is commonly divided into the Paleolithic, Neolithic (8000–1500 BC), Bronze Age (1500–100 BC), and Iron Age (first century BC–AD third century), which broadly aligns with periodization schema used throughout northeast Asia (China, Mongolia, Korea, and the Russian Far East) with the important exception of Japan. The use of the term "Neolithic" in northeast Asia differs significantly from its use in western Eurasia, where the arrival of the Neolithic is mainly demarcated by the domestication of plants and animals and the transition to agriculture and animal husbandry (Banning 1998; Bar-Yosef 1998; Byrd 1994; Weisdorf 2005; Zvelebil 2001). In northeast Asia, the beginning of the Neolithic

is instead marked by the appearance of pottery (Kuzmin 2010), which emerged by at least 13,000 BC (Craig et al. 2013; Yanshina and Kovalenko 2022) but with significant diachronic variation from region to region. For example, while Pleistocene pottery is known from China, Japan, and the Russian Far East (Shoda et al. 2020; Yanshina 2017; Yanshina and Kovalenko 2022), the earliest examples of pottery in Korea appeared by 8000–7000 BC (Kim et al. 2020), by which pottery had become more-or-less a universal feature of Neolithic technology throughout northeast Asia. More significantly, the earliest examples of pottery production and use throughout northeast Asia are not related to the development of agriculture or animal husbandry and seem to have instead been first taken up by hunter-gatherer-fishers (Craig et al. 2013; Gibbs et al. 2017; Shoda et al. 2017). When evidence for plant domestication first appeared, rather than a regional transition toward agricultural economies, the Neolithic in northeast Asia was characterized by an eclectic patchwork of diverse cultivated crops and large regional and chronological variations both in their importance and the ways in which they were utilized.

The earliest seed crops known to have been domesticated in northeast Asia are foxtail millet (*Setaria italica*) and broomcorn millet (*Panicum miliaceum*), which show evidence of cultivation as early as 8000 BC in northern China (Yang et al. 2012). Some of the earliest domesticated millet is from Xinglongwa settlements (ca. 6200–5400 BC), located in the West Liao River basin, which have been associated with pottery production, millet cultivation, hunting and gathering, and potential pig husbandry (Liu et al. 2012). Farther south in the Yi-Luo River basin, early examples of mixed millet and rice cultivation—rice having been introduced from southern China—are associated with Peiligang settlements (ca. 7000–5000 BC), which also show evidence of millet and rice cultivation alongside hunting and gathering and possible pig husbandry (Zhang et al. 2012). Within a couple of millennia, increasingly complex societies that were highly dependent on agriculture and pig husbandry had developed in both the West Liao River basin and Yi-Luo and Yellow River basins, represented by the succeeding Hongshan (ca. 4700–2900 BC) and Yangshao (ca. 5000–3000 BC) periods, respectively (Deng et al. 2024; Liu and Chen 2012; Liu et al. 2012).

Toward the end of the Hongshan and Yangshao periods, domesticated millets appeared throughout much of northeast Asia, including along its coastal peripheries, although the precise processes and routes behind their spread are not well known (but see Hudson et al. 2020; Li et al. 2020; Robbeets et al. 2021). However, rather than leading toward full-fledged agricultural transitions, foxtail and broomcorn millets were incorporated into existing hunting-gathering-fishing economies in many areas and were combined with small-scale cultivation of other indigenous crops. For instance, foxtail and broomcorn millet both arrived in Korea and Russia's Primorsky Krai by approximately 3500 BC (G.-A. Lee 2017; Leipe et al. 2019; Li et al. 2020; Sergusheva et al. 2022), but there is strong evidence for the sustained importance of hunting of marine and terrestrial animals (An 2006; Choy et al. 2012; Choy and Richards 2009), foraging of staple plant foods such as acorns, walnuts, and chestnuts (Ahn 2012; Kuzmin 2010, 2013), and cultivation of other wild plant taxa including soybean (*Glycine max*), azuki bean (*Vigna angularis*), and perilla (*Perilla frutescens*) among the Neolithic

economies in these regions (Kuzmin 2013; G.-A. Lee 2013, 2017). Interestingly, there is no evidence that foxtail millet and broomcorn millet reached Japan until the last phases of the Jomon period (ca. 13,000–900 BC) (Nasu and Momohara 2016), despite evidence for sustained interaction between Neolithic inhabitants of the eastern coast of Korea and the southwestern coast of Japan (Crawford 2011; Kuzmin 2024). While there was a great deal of variation in the subsistence activities throughout the several-millennia span of Japan's Jomon period, Jomon inhabitants likely cultivated and domesticated another species of millet, barnyard millet (*Echinochloa esculenta*), independently, while mainly relying on hunting, gathering, and fishing of berries, acorns, chestnuts, and horse chestnuts to support, in some phases, large village communities (Bleed and Matsui 2010; Crawford 2011). Furthermore, unlike in much of northern China, pig husbandry and the rearing of other domesticated animals besides dogs appear to have begun much later in Korea, Japan, and Primorsky Krai, after the fully fledged transitions to agriculture of their respective Bronze Ages (or in the case of Japan, the Yayoi period) (Price and Hongo 2020).

A lack of evidence for the spread of domesticated foxtail and broomcorn millets makes the picture unclear farther north, for example, in present-day Mongolia and Siberia. Nonetheless, the growing body of archaeobotanical, zooarchaeological, and stable isotopes data from peripheral coastal and insular northeast Asia—Korea, Japan, and Primorsky Krai—suggest that rather than referring broadly to a Neolithic of northeast Asia, it would be more appropriate to emphasize the spatial and diachronic variability among Neolithics of northeast Asia, particularly in terms of subsistence lifeways and the roles plant cultivation and animal husbandry played in these. While there does not appear to be a point in time in which a single, common subsistence lifeway characterized all the Neolithics of northeast Asia contemporaneously, the common thread that tied them together from their beginnings was the universality and importance of pottery production (Popov et al. 2014; Sato and Natsuki 2017; Uchiyama et al. 2014).

In Korea, the transition to a fully agricultural economy occurred abruptly, following the introduction of rice cultivation in the mid-second millennium. Most likely domesticated in southern China by 8000–7000 BC, rice had spread northward and was taken up by Neolithic societies in northern China, as seen in the Peiligang and Yangshao traditions (Deng et al. 2024). From around 1500 BC, rice appeared abruptly on the Korean Peninsula and spread rapidly accompanied by an entirely new material culture assemblage, including undecorated, coarse-ware Mumun pottery, large semi-subterranean longhouses, and new polished stone tools, including semilunar reaping knives and daggers. This association of a new economy and material culture is referred to as the Bronze Age by Korean archaeologists, as evidence of bronze items—mostly consisting of ritual and ceremonial items such as daggers and mirrors—first appeared in this period, associated with rice, but remained rare until the latest phase of the period. The Bronze Age also witnessed a rapid florescence in the number and size of archaeological sites, suggesting a boom in population and the aggregation of large-scale village communities (Oh et al. 2017). Social complexity significantly increased during the Bronze Age. Following the Bronze Age, the Iron Age, also known as the Proto-Three-Kingdoms period, began around 100 BC

with the introduction of iron from China, followed by the development of states during the subsequent Three-Kingdoms period (AD third-seventh century).

The emergence of states was a long-delayed process in Korea and Japan, and the trajectories of state formation in northeast Asia show considerable diversity. Although the date of state formation is debated due to varying definitions of early states and differing interpretations of historical records (Allan 2007; Shelach and Jaffe 2014), it is argued that the Bronze Age of the Central Plains of China witnessed the formation of states as early as 1800 BC (Liu 2009). In present-day northeast China, adjacent to the Korean Peninsula, historical texts record that an early state called Gojoseon emerged in the first millennium BC. Many lines of archaeological and historical evidence suggest that Bronze Age inhabitants of Korea engaged in interaction with various polities in contemporaneous China during the Western Zhou (11th–eighth century BC), Spring and Autumn period (770–481 BC), Warring States period (481–221 BC), and Qin/Han period of China (Korean Archaeological Society 2022). These interactions likely influenced the process of community formation on the Korean Peninsula but did not directly result in the emergence of states.

The Neolithic and Bronze Age of Korea are delineated by a major shift in subsistence lifeways that, we believe, contributed to completely different trajectories of community formation. While plant cultivation is a component of both periods, the Neolithic is characterized by the continuity of a tradition of hunting, gathering, and fishing that goes back to the turn of the Holocene, whereas the Bronze Age saw a rapid and more complete commitment to agriculture following the arrival of new crops, rice (*Oryza sativa*), wheat (*Triticum* sp.), and barley (*Hordeum* sp.). For these reasons, the use of the terms Neolithic and Bronze Age may seem to fail to capture the context of the two periods within the broader context of northeast Asian prehistory. As such, many East Asian researchers favor the alternative terms, "Chulmun period" and "Mumun period," and we use them to denote the Neolithic and Bronze Age, as it is commonly used by archaeologists working in Korea.

We review works on the Chulmun period and Mumun period separately, primarily due to the aforementioned differences and perceived discontinuity between the two periods. Although both periods witnessed the emergence of large villages, the scale of the villages and causes and processes behind their establishment differ significantly. Emphasis is placed on how the nature and scale of villages changed over time, how changes in the scale and organization of villages were related to land use, subsistence practices, social complexity, the spatial diversity of processes of aggregation and subsequent responses, and most importantly how archaeologists working in Korea understand the formation of community throughout both periods. Numerous debates on the formation of community during the Chulmun and Mumun periods revolve around epistemological considerations concerning the relationship between villages as spatial clusters of dwellings and communities as “the conjunction of people, places, and premise” (as per Yaeger and Canuto 2012). Similarly, archaeologists of Korean prehistory hold varied views on the relationship between the emergence of large villages and community formation.

Our review is organized to first provide an overview of general understandings and interpretations of the archaeology of each period chronologically. However, because processes of community formation, both within and beyond the village,

are interwoven with many other social, economic, and political aspects of prehistoric lifeways, our discussions address multiple broader themes that we find pertinent to understandings of community formation, including, but not necessarily limited to, foraging and farming, mobility and sedentism, dispersion and aggregation, and sociopolitical complexity and scalar stress. Special attention is given to spatio-temporal dynamics of demography across these periods, as both a potential driver and a potential outcome of major changes in Chulmun and Mumun lifeways. While investigating past population dynamics remains challenging, researchers have worked to statistically mitigate problems associated with using radiocarbon data as a proxy for population and/or occupation intensity (e.g., Carleton and Groucutt 2021; Crema 2022; Crema et al. 2017; Oh et al. 2017; Palmisano et al. 2017; Timpson et al. 2014), and many archaeologists working in Korea have recognized the potential utility of these methods in exploring questions related to community formation and change (Ahn et al. 2015; M. Kim 2022; Oh 2023; Oh and Conte 2022; Wright et al. 2020).

The Chulmun Period

Despite significant geographical diversity in material culture and subsistence patterns, prehistorians of Korea generally divide the Chulmun period (ca. 8000–1500 BC) into four phases: the Initial, Early, Middle, and Late. The Initial Chulmun (8000–6200 BC) is characterized by the appearance of the earliest pottery in Korea, much later than the Russian Far East, northeast China, and Japanese Archipelago. Yet, only one open-air site is known from this period, and the emergence of settlements and substantial use of pottery did not begin until the onset of the Early Chulmun (6200–4500 BC). In the following Middle Chulmun (4500–3000 BC), the number and size of settlements increased, perhaps suggesting both population increase and aggregation. In the Late Chulmun (3000–1500 BC), settlements radically decreased in number and size, while the number of temporary camps and limited-activity stations increased, which may suggest a period of population decline and/or increased mobility.

Village Formation in the Chulmun Period

Early Pottery-Using Inhabitants: The Incipient Gosan-ri Site

Radiocarbon dates from the final Pleistocene in South Korea indicate that population on the peninsula was relatively large during the Last Glacial Maximum (LGM) but that it declined steeply following the onset of the Holocene (J. Kim and Seong 2022a; Seong and J. Kim 2022). In contrast, occupation intensity was low during the LGM but seems to have increased in the early Holocene in northern China and the Russian Far East, where many sites are distributed along the lower and middle Amur River basin. Seong and J. Kim (2022) have suggested that these fluctuations reflect occupation of the Korean Peninsula as a refugium by hunter-gatherers who

had occupied high-latitude areas during the cold climate of the LGM, followed by relocation northward as the climate warmed after the end of LGM through the early Holocene.

Pottery was first produced during the post-LGM Pleistocene in northeast Asia, in particular in the Japanese Archipelago and the Russian Far East. In the Russian Far East, the Khummi site, from which the oldest pottery sherds in the region have been found, dates back to before 13,000 BC (Cohen 2013). Early pottery of the continental East Asian Pleistocene was used by mobile hunter-gatherers, and the sites are mostly distributed along the lower/middle Amur River basin (Cohen 2013; Kim and Seong 2022a; Kuz'min 2019; Shoda et al. 2020; Yanshina 2017; Yanshina and Kovalenko 2022). In contrast, Pleistocene pottery has not been discovered on the Korean Peninsula, and it is unlikely that this is a result of a lack of archaeological investigation, as Korea is one of the most densely excavated regions of Eurasia. Rather, the absence of Pleistocene pottery may be best accounted for by the scarcity of archaeological sites in Korea in the post-LGM Pleistocene (J. Kim and Seong, 2022a; Seong and J. Kim 2022). Even after the onset of the Holocene, there is a conspicuous lack of pottery on the peninsula for at least the first couple of millennia.

"Gosan-ri-type" pottery is the earliest known from Korea, appearing by approximately 7800 BC on Jeju Island (J. Kim and Seong, 2022b; So 2017), approximately 80 km from Korea's southern coast (Fig. 1). In fact, Gosan-ri is the only site that belongs to the Initial Chulmun. Gosan-ri-type pottery is a coarse-grained earthenware that is distinctive for its lack of decoration and high quantities of plant temper,

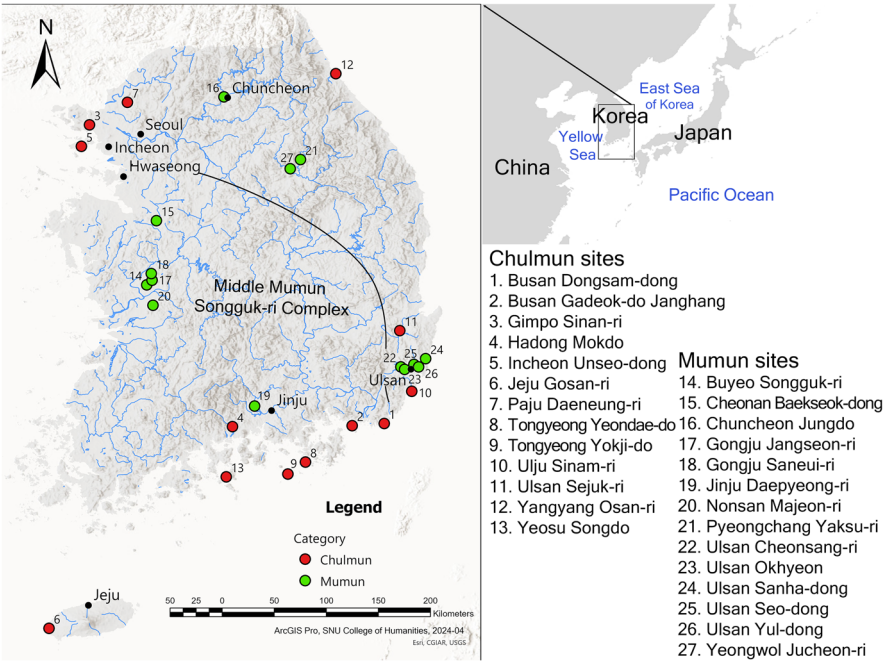

Fig. 1 Map of South Korea with Chulmun and Mumun sites and cities mentioned in this article

traces of which are often visible on the surface of the vessels (Lee et al. 2019). Early dates, mostly obtained from charred material adhered to the surface of the ceramics, reveal that Gosan-ri is the earliest Chulmun site, but these appear mostly as surface scatters, and it is difficult to assess the association between Gosan-ri-type pottery and features. Dates taken directly from the Gosan-ri-type pottery are concentrated between 7800 and 7500 BC (M.-J. Kim et al. 2020), but those directly associated with dwellings and pits at the site date to around 6200 BC (J. Kim and Seong 2022b), suggesting a substantial occupational hiatus between the use of the earliest pottery and later features at the site. Thus, while the Gosan-ri site provides the earliest evidence of pottery-using inhabitants in the Chulmun period, the earliest pottery was not likely accompanied by more permanent structures such as dwellings and pits, which might indicate the presence of villages (So 2017).

Maritime Adaptations and the Emergence of Village Communities: The Early Chulmun

After a long period with no evidence for occupation during the post-LGM Pleistocene through the Early Holocene, settlements emerged along the eastern and southern coasts of the Korean Peninsula around 6200–6000 BC, at the onset of the Early Chulmun phase (Fig. 2). On the eastern coast, this phase is associated with the Osan-ri pottery tradition, and on the southern coast, the Yunggimun pottery tradition. Various lines of evidence, including analyses of tool assemblages (Ha 2011; Lee 2014), zooarchaeological remains from shell middens (E. Y. Kim 2012; G. Kim 2011), stable isotope analyses of human skeletal remains (Choy et al. 2012; Choy and Richards 2009; Shin et al. 2013), and pottery residue analyses (Kwak et al. 2020), indicate that these new settlements were supported by a broad-spectrum economy that depended heavily on maritime adaptations. This trend of increasing settlement occupation along coasts coupled with an emphasis on marine resources was not limited to the Korean Peninsula. The Rudnaya and Boisman traditions also

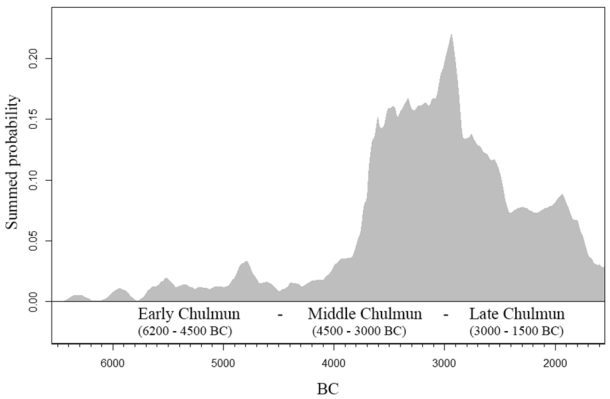

Fig. 2 An SPD of 603 radiocarbon dates associated with Chulmun sites (rolling mean by 100 years, binned by sites using 100 years of bin size with 327 bins, made by rcarbon package in R)

appeared on the coastlines of the Russian Far East in areas where previous hunter-gatherer occupations were unknown (Lyashchevskaya et al. 2022). Considering the simultaneous appearance along the east coasts of continental northeast Asia of hunter-gatherer sites around 6200 BC and the stylistic and technological affinities in ceramics between these traditions and the lower and middle Amur River basin, J. Kim and Seong (2022a) have suggested that pottery-producing hunter-gatherer groups that were once centered on the middle and lower Amur River basin may have spread outward to coastlines in response to the 8.2kya cooling event and developed new maritime adaptations.

Along the southern coast of Korea, shell middens provide the main evidence for increasing occupational intensity of maritime-adapted hunter-gatherer communities. More than 250 shell middens dating to the Chulmun period have been identified along Korea's southern coast, many of which contain Early Chulmun layers (Korean Cultural Heritage Association 2010). While dwellings associated with the Early Chulmun phase along the southern coast are rare, a small number of dwellings have been discovered associated with shell middens at some sites. Excavations in the last few decades have uncovered dwellings dating to the Early phase on the southern coast at the Dongsam-dong, Mokdo, and Songdo shell middens (Koo 2010). Though small in number, the discovery of dwellings suggests that some shell middens were composite sites, in which settlements can be directly linked to middens that reflect a particular focus on marine resources by their inhabitants. Shell midden layers at many sites located on both the mainland peninsula, such as Busan Dongsam-dong, Ulsan Sejuk-ri, and Ulsan Shinam-ri, and close-lying islands, including Tongyeong Yokji-do and Yeondae-do, provide evidence of the wide variety of fish, shellfish, and marine mammals that were exploited (Bugyeongmunmul Research Institute 2017; Han and Im 1993; Jinju National Museum 1989; G.-A. Lee 2017; National Museum of Korea Archaeology and History Division 2002–2005). In addition to the wide range of animal taxa discovered from these sites, a high diversity of stone tools, clay figurines, and pottery suggests that rather than being used as temporary fishing or harvesting camps, these shell middens were likely refuse middens for settlements (Koo 2010; J.-J. Lee 2002).

Burials also provide another line of evidence, albeit indirect, for the presence of communities in the Early Chulmun of the southern coast. At the Yokji-do shell midden, a total of four burials were identified within cairn-like features, with human skeletal remains buried with hunting and fishing tools and adorned with shell ornaments (Jinju National Museum 1989). The burial of multiple individuals in close proximity and investment in the burials may imply communal funerary practices, although it is unclear how large the community was and where it resided. The Gadeok-do Janghang burials located on an offshore island provide a good example of the potential scale of a Chulmun period burial ground with the remains of at least 48 interred individuals excavated. The majority of the individuals were buried in a crouched position, suggesting some manner of communally shared mortuary practices among the interred, while the presence of some 90 outdoor hearths adjacent to the burial area (Korean Archaeology and Art History Research Institute 2014) indicates that the location was frequently visited. Nearby dwellings have not been found, but its location not distant from the large-scale

Dongsam-dong shell midden implies a high level of occupation intensity along Korea's southeastern coast.

The eastern coast of the Korean Peninsula also saw a similar trend toward increasing occupation intensity and maritime adaptations, although here, dwelling features provide the main evidence. For instance, multiple dwelling features were discovered at the Yangyang Osan-ri site, located on the banks of a coastal lagoon on the eastern coast of Korea. Yangyang Osan-ri also is a multi-phase site from which both early (Osan-ri-type pottery) pottery and Middle and Late phase (Chulmun pottery) has been discovered, but six dwellings were excavated from Level V, the lowest layer associated with the earliest radiocarbon dates, spanning 6000–5000 BC (Im and Kwon 1984; Im and Lee 1988; W. Kim et al. 1985). The dwellings are round or rectangular and slightly dug into a sandy surface with central hearth features, and numerous lithic and ceramic artifacts were recovered from their floors. Of particular interest are the large quantities of polished stone composite fishing hooks and net sinkers recovered from the dwellings (Im and Kwon 1984; Im and Lee 1988; W. Kim et al. 1985), which indicate maritime adaptations, and in particular, the importance of deep-sea fishing. Later excavations carried out between 2006 and 2007 resulted in the discovery of at least four additional Early Chulmun dwellings (Yemaek Institute of Cultural Heritage 2008).

The development of maritime adaptations along coastal northeast Asia corresponds with the emergence of localized ceramic styles. Early pottery of the Pleistocene and Early Holocene, which was concentrated along the lower and middle reaches of the Amur River in the Russian Far East, was not decorated. Although some patterns appear on the surfaces of early pottery (Yanshina and Kovalenko 2022), these are traces of surface treatments, using cord-wrappings, sticks, shells, and bones, and similar traces of rolling and combing are also found on interior surfaces, suggesting that many of the patterns observed may not have been stylistic decorations (Yanshina 2017). By contrast, once settlements and dense shell middens emerged along the eastern coasts of continental northeast Asia, localized ceramic styles such as Rudnaya, Boisman, Osan-ri, and Yunggimun emerged, and it became possible to distinguish pottery styles based on decorations and patterns. Although it is difficult to equate the development of local ceramic styles with the formation of community identities, the emergence of regionalized pottery styles at least suggests an intensification of local interactions and sharing of techno-stylistic behaviors, likely resulting from increased sedentism and day-to-day interactions within a village community context.

Although Early Chulmun settlements are relatively small compared to those of the following Middle Chulmun, they provide evidence of the first settled co-residential communities on the Korean Peninsula. Issues such as the contemporaneity and permanence of occupation and the frequency of residential movements require further scrutiny. However, if settlements serve as a proxy for village communities, then the presence of multiple dwellings, the formation of directly associated large, extensive shell middens, regionalized pottery styles, and the appearance of designated burial areas suggest the Early Chulmun may be regarded as a first stage in the formation of village communities on the Korean Peninsula.

Village Aggregation: The Middle Chulmun

The beginning of the Middle Chulmun (from ca. 4500–4000 BC) is marked by the first evidence of post-Pleistocene occupation in the western coast and river basins of Korea, which for many millennia following the onset of the Holocene, were devoid of long-term occupation that left behind material traces. The appearance of settlements, shell middens, and other sites in the western subregion around this time was concurrent with the appearance of the eponymous comb-patterned Chulmun pottery, which, over the Middle to Late phases of the Chulmun period, gradually became the dominant style of pottery produced throughout the Korean Peninsula.

Middle Chulmun sites in western Korea can be broadly classified into settlements and limited-activity stations (J. Kim 2010). The major criteria distinguishing the two are site function and the relative total occupation span (over years) and permanency (throughout the year) of the sites. Settlements consist of multiple pit dwellings, built with posts, entrances, earthen platforms, and substantial superstructures, implying a high degree of investment in dwelling construction (Conte 2019). Lithics and ceramics recovered from settlement sites are diverse, suggesting a broad range of activities, including but not limited to food processing and consumption, pottery production, and stone-tool manufacture, were carried out within settlements in the Middle phase (Bae 2007; Conte 2019; Yoo 2012). Storage pits are also found at many settlement sites, both within and outside dwelling features, suggesting substantial and permanent or semipermanent occupation of many settlement sites (Yoo 2012).

In contrast, there are more than 100 roughly contemporaneous sites that yield no evidence for long-term occupation. Most of these are shell middens distributed along the western coast and on small offshore islands, often where no permanent sources of freshwater were available. Despite intensive excavations, substantial dwelling features have not been found associated with shell middens on the western coast, although remains of some open-air camps with temporary structures and open-air hearths are occasionally found (Im et al. 2001, 2002). Taking this evidence into account, researchers have suggested that shell middens on the western coast of Korea during the Chulmun period were likely limited-activity stations that were visited temporarily and logistically by settlement inhabitants for the purposes of procuring marine resources (Conte 2024; J. Kim 2005, 2006a; J. Kim and Yang 2001). Chulmun shell middens on Korea's western coast are, thus, unlike the shell middens of the Early Chulmun phase on Korea's southern coast, which are thought to have been refuse heaps for settlements and likely point to different patterns of mobility, settlement, and resource procurement for the Middle phase.

Compared to the Early Chulmun phase, settlements in the Middle Chulmun phase are conspicuously large, with the first large-scale settlements, consisting of more than 20 dwellings, established during the early stages of the phase (Conte 2019; M. Kim 2022; M. Kim et al. 2015). Not only the scale of individual villages but the total number of dwellings throughout Korea reached a peak in this phase, as reflected in a summed probability density (hereafter SPD) of radiocarbon dates from the Chulmun period (Fig. 2). Currently, the largest known settlement, in number of dwellings of excavated, is Incheon Unseo-dong, on a large island only a few kilometers off of Korea's northwestern coast. A total of 66 dwellings associated with

Chulmun pottery were excavated at this site, along with numerous pit features and outdoor hearths (Central Institute of Cultural Heritage 2010). Although the excavators of the site suggest that it is unlikely that all of the dwellings were contemporaneously occupied, the sheer scale of the site makes it the largest settlement site known from the Chulmun period. Other large sites are located farther inland, such as Paju Daeneung-ri, on the slope of a low-lying hill approximately 20 km inland from the west coast, where 39 pit dwellings dated mainly to 3700–3600 BC were excavated (Fig. 3) (Korea Ceramic Foundation et al. 2017). Gimpo Sinan-ri is another more recently excavated settlement located at the confluence of the Han River and the Yellow Sea, where a total of 35 Chulmun pit dwellings have been unearthed with associated radiocarbon dates centering around 3700–3500 BC (Gyeonggang Institute of Cultural Heritage 2020).

Although it is certain that the size of settlements became much larger than in the Early Chulmun, whether the large settlements observed near the start of the Middle phase were indeed representative of large-scale, contemporaneous village communities or palimpsests of small-scale occupations accumulated over a long period of time is a matter of debate. On one hand, close distributions of radiocarbon dates, a lack of overlapping features, and potential planning in the structure of the settlements have been put forward to suggest that some of these settlement sites were contemporaneously occupied and thus representative of large co-residential communities (Conte 2019; Lim 2010; Yoo 2012). On the other hand, others argue that many large-scale sites likely represent a palimpsest of occupations occurring over a number of distinct phases (M. Kim 2022). Although debates over the question of the contemporaneity of occupation of each settlement site will likely never be solved to the satisfaction of all researchers, it is clear Middle phase settlements represent occupations of a greater scale than those observed in the Early phase, and determining how and why larger settlements emerged in the Middle phase remains a major question of interest (M. Kim 2022; M. Kim et al. 2015). Despite potential variation

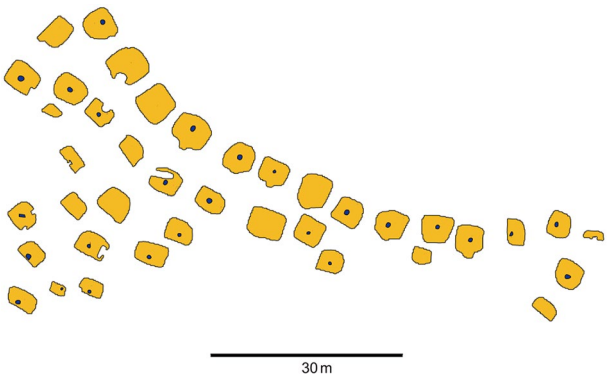

Fig. 3 Arrangement of 39 Chulmun period pit dwellings at the Paju Daeneung-ri site. Dates of multiple dwellings to approximately 3700–3600 BC and possible linear arrangement of dwellings may suggest that the site was a relatively large, contemporaneously occupied settlement of the Middle Chulmun phase. Circular features in blue within dwellings represent locations of pit hearths and stone-lined hearths (redrawn by authors) (Color figure online)

in their overall size and the possibility that they were not occupied permanently by the entire co-residential group throughout the year, the Middle Chulmun settlements in the western coastal basin represent an aggregation of groups on a scale not observed prior to this phase. An equally intriguing issue is the apparent ephemerality of these large aggregations on a broader time scale. The largest settlements discovered thus far in the Middle Chulmun date to before 3500–3400 BC, after which Chulmun settlement sites became increasingly small, dispersed, and spread beyond the western basin of Korea throughout the Middle and Late phases.

Dissolution of the Village? The Late Chulmun

Settlements and limited-activity stations continued to be distributed contemporaneously through the Late Chulmun. However, the overall scale of settlements and the total number of dwellings peaked in the first half of the Middle Chulmun and steadily declined through the Late phase (Fig. 2). With only a few exceptions, the majority of Late Chulmun settlements consist of a cluster of one to three dwellings (Conte 2019; M. Kim et al. 2015; Lim 2008; So 2013), which has been interpreted as reflecting a decrease in population (Oh et al. 2017). At the same time, outdoor hearth sites increased in number, which may suggest changes in the frequency and/or distance of mobility rather than population decline (Ahn et al. 2015).

Another major change in settlement patterning is the overall distribution of settlement sites. In the first half of the Middle Chulmun, settlement and limited-activity sites were distributed only on the coast and estuaries of the western coastal basin. However, after 3500 BC, sites associated with Chulmun pottery began to spread south and east as well as into the valleys of the mountainous interior, and by the Late Chulmun, Yunggimun pottery on the southern coast and Osan-ri type pottery on the eastern coast were replaced entirely by Chulmun pottery. Potential causes for this geographic expansion and the simultaneous downsizing of settlements have yet to be investigated in great detail. Notably, millet cultivation began in the Middle Chulmun, not long before settlements began to become smaller and expand farther outward, but it is unclear if and how cultivation may relate to these changes. Some authors have suggested that shifting or slash-and-burn cultivation promoted increasing mobility (Ahn 2005; Song 2001), but these interpretations are not supported by archaeological evidence and instead rely largely on step-wise models of agricultural intensification (e.g., Boserup 1965) that have since been called into question (Bogaard et al. 2013; Doolittle 2004; Jacomet et al. 2016). Other researchers assert that environmental deterioration led to decreasing population and/or increased mobility (Ahn et al. 2015; Park et al. 2021), but evidence for purported changes in temperature, precipitation, and/or vegetation are often contradictory, and the decline in settlement size and number predates the well-known 4.2 kya event by at least a millennium (H. Kim et al. 2021). Setting aside potential causes, there is a clear trend toward a decline in settlement size and a broadening of the geographic distribution of sites. Sites associated with Chulmun pottery replaced those associated with earlier pottery traditions along the eastern and southern coasts, while simultaneously spreading into the previously unoccupied interior. While little is known about the processes behind this Chulmun pottery expansion, it is clear that it resulted in the

decline of large-scale village communities in favor of small, co-residential groups that were likely more frequently mobile. By the end of the Chulmun period, settlement sites became virtually invisible archaeologically, and Chulmun pottery is only found at ephemeral sites such as small shell middens and outdoor hearths, which closely coincides with the arrival of the Mumun agriculturalists.

Themes in the Formation of Chulmun Communities

Mobility, Sedentism, and the Co-residential Community

As briefly discussed above, one major question that remains is whether the large-scale village sites that emerged in the Middle phase represent large-scale communities on the one hand, or aggregates of multiple small co-residential groups in a mobile context on the other. The distribution of radiocarbon dates associated with dwellings, the diversity of artifacts and features, and the overall structure of village sites have been used to suggest that the Middle phase large-scale village sites were more-or-less sedentarily occupied by relatively large communities (Conte 2019; So 2013; Yoo 2012). Others have suggested that many of the large-scale village sites likely represent multiple episodes of occupation by smaller groups (M. Kim 2022; Yi 2022). The former emphasizes high investment in a large number of dwelling structures and other features, such as pits, that imply some level of permanency in occupation. However, these interpretations often fail to take into account both the diversity of mobility strategies employed by foragers and the potential variability in the lifespans of settlements. Meanwhile, the latter view emphasizes mobility and residential fluidity but relies on the assumption that mobility and scalar stress preclude sustained large village communities among hunter-gatherers.

Conceptualizations and interpretations of mobility and sedentism, therefore, play an important role in how researchers have understood the patterning of settlement sites and the cohesiveness of co-residential communities in the Chulmun period. Much of the debate centers around whether the village site is representative of a single, large community or an aggregate of multiple occupations occurring over long timespans. Lack of highly detailed stratigraphic information makes it difficult to distinguish in many cases between multiple, palimpsest occupations and contemporaneous occupational episodes, particularly if dwellings have been continuously used and reused for more than a single generation. Interpretations of overall settlement structure, whether based on qualitative or quantitative analyses, remain largely subjective: in the end, the researcher must decide whether to lump or split dwellings as belonging to the same co-residential group within a settlement based on parameters set by the researcher. Perhaps more importantly, in focusing on settlements in isolation, the purported mobility and/or sedentariness of the past inhabitants of archaeological sites are often overlaid post hoc, as a means of interpreting settlement scale and structure rather than an object of analysis in its own right.

A major impediment to analyzing the role of mobility in the Chulmun period of Korea and elsewhere has been a tendency to misconceptualize mobility and sedentism as occupying opposite ends of a mobility spectrum (Conte 2019; Grove 2009;

Kelly 1992). In this conceptualization, "increased" mobility is assumed to reduce sedentism, and "increased" sedentism reduces mobility. However, more nuanced understandings recognize multiple dimensions of mobility, including intra- and inter-annual frequency and distance of mobility (Conte 2019; Grove et al. 2023), different and changing scales of mobile groups (Feinman and Neitzel 2023; Grove 2009), and varied yet often overlapping objectives (Feinman and Neitzel 2023; Whallon 2006). Importantly, combinations of these different dimensions of mobility may actually encourage sedentism, and all of them are necessarily embedded in the social and labor organization of any given society (Feinman and Neitzel 2023). And while uncovering the details of what proportion of community members engaged in mobility at a given distance at any given time may be impossible to determine archaeologically, ethnographic observations of the multidimensionality of human mobility require archaeologists to look beyond the mobility/sedentism spectrum.

An alternative approach to the problem has been to consider how mobility is utilized on a broader scale, taking into consideration not only the size and contemporaneity of settlement occupations but also how village inhabitants utilized resources distributed differentially across the landscape. Researchers have long recognized that shell middens on close-lying islands off Korea's western coast were likely visited by task groups for specific purposes rather than accumulating as refuse middens for settlements (Conte 2019, 2024; J. Kim 2005, 2006a, 2010; J. Kim and Yang, 2001; J.-J. Lee 2002). These interpretations are strengthened by a total lack of dwelling features associated with the shell middens (Conte 2024) as well as a low diversity of lithic tools (E. Y. Kim 2012; J.-J. Lee 2002). Furthermore, unlike the large shell middens on the southern coast of Korea that show a wide variety of exploited shellfish, between 90 and 99% of edible animal remains from several middens on the west coast consist of a single species of oyster (G. Kim 2011)—the Pacific oyster, *Crassostrea gigas*—further supporting the notion of targeted exploitation of oysters at shell midden locations by logistically mobile groups.

The possibility of logistical movement (i.e., planned mobility undertaken by subsets of a co-residential population) for the purposes of exploiting specific marine resources has been more explicitly tested by comparing the diversity of formal and stylistic traits of ceramics recovered from settlement sites versus shell middens (J. Kim 2005, 2006a; J. Kim and Yang 2001). J. Kim (2006a) finds that ceramic styles were far more diverse at shell middens compared to the homogeneity of ceramic styles recovered from settlement sites, suggesting that (1) co-residential village communities likely shared preferences for common ceramic stylistic traits and (2) task groups originating from multiple settlement sites likely visited and utilized the same shell midden locations. Later geochemical analyses of pottery from large-scale settlement sites and shell middens located in the western coastal basin lend further support to these findings, with the majority of sherds recovered from within sampled settlements sharing similar geochemical compositions across multiple elements, whereas those from shell middens reveal much greater variation in geochemical compositions, with many shell midden sherds geochemically overlapping with those retrieved from settlement sites in the study. The similar geochemical composition of clays used to produce pottery within settlements further implies that pottery was likely produced predominantly by village community members within settlement

sites and then were transported by task groups visiting shell midden locations for use in processing fish and shellfish (Conte 2024).

The proposition that large-scale archaeological village sites represent large-scale co-residential communities, then, need not rely on an assumption of a lack of mobility. On the contrary, relatively frequent and long-distance logistical mobility to and from villages may have been a prerequisite for the formation and maintenance of large-scale village communities in the Middle phase of the Chulmun period that were likely also highly sedentary (Conte 2019), if we define sedentism as the presence of a majority of the members of a co-residential community within a particular location for the majority of the year (Kent 1992). The importance of frequent and long-distance logistical mobility in Chulmun land-use strategies may also suggest a certain degree of fluidity in the structure of Chulmun village communities. The presence of temporary camps and limited-activity stations located both inland and along coasts several tens of kilometers from settlements suggest that subsets of village communities frequently moved throughout the region for a variety of purposes that were not limited to but certainly included food-acquisition activities. Frequent movement of certain portions of the community at any given time supports perspectives that emphasize the social flexibility that likely characterized large village sites (M. Kim 2022; Kim et al. 2015). Furthermore, there is evidence that day-to-day interactions were not restricted to those between residents of the same village. While sharing access to shell midden locations may have been a strategic choice on the part of Chulmun foragers to remove the potential costs of territorially defending shellfish-harvesting locations (J. Kim 2006a), the presence of pottery that likely originated from multiple inland locations as well as rare and exotic items, such as jade and obsidian, at some shell middens and other coastal limited-activity stations may also hint at intervillage interactions and exchange between subsets of village communities and greater coordination in the utilization of these common-pool resources (Conte 2024). Regardless, both scenarios suggest that subsets of a larger village community almost certainly moved frequently and likely for diverse purposes, including but not limited to resource procurement, exchange, attending events such as funerals, marriages, and festivals, moving between households, and visiting relatives and exchange partners (as per Feinman and Neitzel 2023; Whallon 2006). While it is impossible to determine how these groups were defined by others or how they self-identified, it is likely that the Chulmun village community was not perceived as permanent or static; residents of villages came and went frequently, and a high degree of fluidity likely characterized Middle phase Chulmun communities, particularly in contrast to later Mumun period village communities.

The Roles of Plant Cultivation, Hunting, and Gathering

For many years researchers of the Chulmun period have debated the purported preeminence of plant-food production versus hunting, fishing, and gathering and their implications for the aggregation and/or dispersion of co-residential communities (Bae et al. 2013; Crawford and Lee 2003; J. Kim 2006a; Lee 2011). Decades of archaeobotanical research have made it clear that at least two species of

domesticated millets, foxtail millet and broomcorn millet, were present and cultivated in Korea in the Middle Chulmun (G.-A. Lee 2017).

In the decade following early published reports of domesticated millets recovered from Chulmun sites (Crawford and Lee 2003), there was a tendency by some researchers to emphasize the importance of millets and employ millet cultivation as a major explanatory mechanism for many of the observed changes in Chulmun social organization. As examples, archaeologists have variously put forward millet cultivation as a major driving factor to explain the formation of village sites (Lim 2008), the dispersion of village sites (J.-H. Ahn 2000; S.-M. Ahn 2005; Song 2001), and even the rise of elite powerholders and increasing inequality (Shin et al. 2012). This emphasis on the potential roles of millet cultivation is not only limited to archaeological interpretation. Robbeets et al. (2021) have attempted to apply the farming/language dispersal hypothesis to assert that millet cultivation was introduced through the large-scale migration of agriculturalists from northeastern China, resulting in the spread of the hypothetical Trans-Eurasian languages throughout northern Asia and the eventual splitting of Koreanic and Japonic languages on the Korean Peninsula (see J. Kim and Park 2020 for a critique of this study)

Although foxtail millet and broomcorn millet are present at many sites that have been sampled for archaeobotanical remains, too few sites representing too narrow of a spatio-temporal range of the Chulmun period have made it difficult to characterize the ubiquity of millet cultivation, the relative importance of millet cultivation over time, and whether millet cultivation even continued unabated throughout the period. Indeed, of about 900 Chulmun sites that were known as of 2017, less than 20 sites had been systematically sampled for archaeobotanical remains, the majority of which fall into the Middle Chulmun (G.-A. Lee 2017). Besides domesticated millets, there also is evidence for foraging and/or cultivation of non-domesticated taxa, including perilla, soybean, and azuki bean (Ahn et al. 2013; Lee 2011; G.-A. Lee 2017); other economically important plant taxa include Manchurian walnuts and acorns (G.-A. Lee 2017). Despite difficult pathways to preservation in the archaeological record, the ubiquity of Manchurian walnuts and acorns at sites suggests that foraging for nuts in particular was a major subsistence activity that may have provided the bulk of plant-food resources (Ahn 2012; Ahn et al. 2015; Stevens et al. 2022) and likely impacted the location of settlements and the seasonal movements of their inhabitants (M. Kim 2022).

Meanwhile, faunal assemblages reveal that hunting, fishing, and shellfish collecting remained major subsistence activities throughout the Chulmun period (Bae et al. 2013; J. Kim 2006a; Norton et al. 1999). Shell middens located along the southern coast of Korea show that dozens of taxa of near-shore and deep-water fish, marine mammals, and shellfish were exploited alongside terrestrial animals, including deer, wild boar, and dogs. Bones of terrestrial animals are found within shell middens on the west coast as well, albeit more rarely, and zooarchaeological block samples taken from shell middens in this subregion are overwhelmingly dominated by remains of a single taxon, the Pacific oyster, suggesting targeted acquisition of oysters, at least at these particular sites (Im et al. 2001, 2002; G. Kim 2011).

Perhaps the greatest indicator of the relative contributions of cultivated millets versus other plant and animal resources in the Chulmun period is provided by stable

isotopes analyses. Skeletal remains of several individuals recovered from the Early phase on the southern coast show highly enriched nitrogen and carbon values, indicative of a diet similar to marine mammals analyzed in the same studies, suggesting heavy reliance on marine resources (Choy et al. 2012; Choy and Richards 2009; Shin et al. 2013). Although remains of only two individuals from the western coastal basin and associated with the Middle/Late phases have been identified, results of stable isotope analyses conducted on these remains suggest a diet that was highly dependent on terrestrial C3 plant resources (An 2006). Although enriched δ13C values from individuals of the Early phase on the southern coast may mask the potential importance of C4 millets, direct dates on carbonized seeds suggest that domesticated millet cultivation did not begin until the Middle phase (but see G.-A. Lee 2017, for a discussion on the possibility of an earlier introduction of domesticated millets based on typo-chronology), so the current stable isotope data suggest that it is unlikely that Early Chulmun inhabitants consumed large quantities of domesticated millets.

Taken together, the wide variety of plant remains, animal remains, and stable isotopes suggest that the Chulmun diet likely varied between subregions, and possibly across chronological phases, but there is no evidence that domesticated millets ever accounted for a substantial portion of the diverse Chulmun diets. One question that remains, then, is determining the importance of cultivation in Chulmun society. Addressing this question necessarily requires a wider set of comparable data, but the collection and comparison of subsistence-related data have been hampered by several factors, some of which are unique to conducting archaeological research in Korea. First, different analytical techniques (e.g., archaeobotany, zooarchaeology, and stable isotope analysis) provide sets of data of different resolutions that are not directly comparable, and differential preservation of plant, animal, and human remains also affects the spatio-temporal distribution of samples that can be collected. In Korea, highly acidic soils prevent the preservation of most organic remains that are not charred or waterlogged, making it difficult to recover human, animal, and plant remains from sites. An even greater issue is the traditional reliance and preoccupation with constructing ceramic-based typo-chronologies in Korean archaeology, which has resulted in a lack of effort to systematically sample for human, animal, and plant remains from sites as they are excavated. The result is that the published archaeobotanical and zooarchaeological data represent only a narrow geographic and temporal range of the Chulmun period, preventing analyses of long-term and interregional changes in the use of plant and animal resources.

Although these problems may be partially ameliorated by improved practices in excavation and efforts to make use of legacy materials—for instance, through residue analysis of ceramics—interpretive issues are not limited only by a lack of data: many disagreements arise from a failure to clearly define "cultivation" and "agriculture," and how cultivation can be variably incorporated with—rather than supplanting—hunting, fishing, and foraging. Cultivation refers to any activities, including but not limited to broadcasting, sowing, transplantation, burning, weeding, and tilling, that promote the growth or propagation of wild or domesticated plants. Although used variously by different writers, agriculture is often used to refer to an economic system in which the cultivation of domesticated plant resources provides

for the majority of the diet (Harris 2007; Smith 2001). Cultivation of millets and many other plant taxa certainly occurred by the Middle Chulmun, if not earlier (G.-A. Lee 2017), but there is no evidence to suggest that millet production made a major contribution to overall diet throughout the Chulmun. It is also clear that engaging in cultivation does not preclude hunting and gathering, and archaeologists now recognize that plant-food production has often been incorporated as an auxiliary component of predominantly foraging economies and, in many cases, can result in stable mixed economies that persist for millennia (Smith 2001).

In the case of the Chulmun period, the available evidence suggests that millet cultivation was not a major impediment to hunting, fishing, and foraging activities. Where millets have been recovered, acorns and/or walnuts are almost invariably also found (Stevens et al. 2022), along with lithic toolkits that attest to the importance of hunting and fishing. Millets have also been found in refuse middens on the southern coast alongside the skeletal remains of hunted terrestrial and marine mammals and shells from a diverse range of shellfish. Although more archaeobotanical and zooarchaeological evidence will add greater detail, it is clear that the introduction of domesticated millets and their cultivation did not set Chulmun foragers on a path toward an agricultural economy. The cultivation of domesticated millets and other plants remained a relatively minor component of a predominantly hunting and foraging economy, a configuration that appears to have remained stable for millennia, with no evidence, as of yet, of an increasing trend toward reliance on millets.

Still, the questions of how plant cultivation may have impacted Chulmun community organization or how community organization may have shaped plant-food production and foraging practices and decisions—if at all—have yet to be explored in any detail. Researchers have suggested that millets provided increased seasonal food security (Lee 2011; Lim 2008; Stevens et al. 2022) or even were regarded as ritually important foods despite their relatively small contribution to the Chulmun diet. But millet cultivation, even on a small scale, may have been limited by certain environmental and ecological parameters as well as scheduling constraints that would have likely acted to facilitate certain social and economic behaviors while disabling others. Thus, investigating the role of millet cultivation, even as an auxiliary activity, will likely provide a better understanding of hunter-gatherer interactions with plant-food production and the potential effects of limited food production on social and labor organization.

Characterizing Chulmun Society

Perspectives of the social and political organization of Chulmun communities and their complexity in terms of scale and structure, divisions of labor, and hierarchy vary considerably. Where some authors describe Chulmun societies as small in scale, resource-poor, and totally lacking any division of labor or organized social or ritual activities (Yi 2022), others see the emergence of elite households, surplus accumulation, and inequality (Shin et al. 2012). These views are not supported by clear archaeological evidence and instead rely more on conjectures about the organizational outcomes of mobility versus sedentism and hunting and gathering versus food production, issues that must be addressed with greater nuance. Frequent and

long-distance mobility coupled with hunting and gathering do not preclude large community sizes and social complexity, just as sedentism and agriculture do not necessitate the emergence of elites and inequality.

The characterization of Chulmun communities as perpetually small, mobile, and lacking resource accumulation cannot be easily applied to the whole of the Chulmun period. Although the maximum size of Chulmun co-residential groups continues to be debated (see above), at least in the Middle phase, there is strong evidence of large-scale settlements, even if rare (M. Kim 2022), potentially housing a few hundred residents, depending on dwelling surface-area-to-residents estimates (e.g., Flannery 2002). In total, such large groups would have required a fairly stable resource base, and variations in lithic and ceramic assemblages among dwelling clusters within villages have been put forward as evidence of some form of horizontal differentiation in labor (M. Kim 2022; Lim 2015). Furthermore, although it is possible to debate kind and degrees of organizational complexity, the presence of shared preferences for pottery designs and the use of communal cemeteries and burial styles seen in the Early Chulmun likely point toward some forms of organized social and ritual activities at localized scales.

Nonetheless, the presence of these features does not provide support for the notion, put forward by Shin et al. (2012), of an emerging elite class in the Chulmun period that managed and redistributed food surpluses. As Ahn et al. (2015) point out, this perspective hinges on the unsupported assumption that cultivation of any intensity and scale leads down a trajectory of increasing reliance on agriculture and surplus production, and even further, that increased reliance on agriculture necessarily results in the formation of elite households. Materially, there is no evidence of social stratification among households or between villages (M. Kim 2022), and moreover, this interpretation almost entirely ignores the available archaeobotanical, zooarchaeological, and stable isotope data, which indicate that hunting, fishing, and foraging of wild animal and plant resources remained the main subsistence activities throughout the Chulmun period (Conte 2024; J. Kim 2006a). Taking into account various lines of evidence for an increasing frequency of mobility and rapid decrease in co-residential group size, Ahn et al. (2015) further suggest the possibility that millet cultivation may have declined or even ceased in the Late Chulmun, which, if supported by further archaeobotanical analyses, would certainly run counter to the narrative of an elite agricultural class forming in the Late phase. Alternatively, it is entirely possible that millet cultivation was simply incorporated into increasingly mobile societies or even played some role in promoting the dispersion of the village aggregations seen in the Late phase, but these remain hypotheses that must be tested.

Other researchers, seeking to emphasize the preeminence of hunting and gathering while also acknowledging some of the seemingly complex organizational features of Middle Chulmun society, have suggested that Chulmun communities be classified as complex hunter-gatherers (Lim 2015). The concept of complex hunter-gatherers was originally put forward to dispel the wide-held misconception that hunter-gatherer societies are universally egalitarian, highly mobile, and rarely engage in accumulation of resources and to draw attention to the many hunter-gatherer societies known both ethnohistorically and archaeologically to have been characterized by large, sedentary

populations, resource accumulation and storage, and clear social stratification (Arnold 1996; Arnold et al. 2016). Allowing that evidence for institutionalized social stratification is lacking for all phases of the Chulmun period, Lim (2015) argues that many of the features associated with complex hunter-gatherers, including sedentism, storage, long-distance exchange, and horizontal differentiation, are observed until the Middle phase of the Chulmun period and suggests that it may be analytically fruitful to investigate these features in terms of degrees rather than adopting a check-list approach to classifying complex hunter-gatherers. While this may further discussion around many of the organizational features of Chulmun societies and how these may have varied both regionally and over time, the concept of complex hunter-gatherers still remains mainly typological, a view that has been criticized by some authors (Kim and Grier 2006; Seong 2023). Indeed, in much of coastal and peninsular East Asia, the tendency to label hunter-gatherers as "complex" (or conversely, "not complex") may mask the temporal and spatial variability that makes these foraging and food-producing societies unique. In the case of the Chulmun period, for example, many of the 'features' associated with complex hunter-gatherers, including sedentism, long-term food storage, and larger co-residential group size, only characterize groups in the western coastal basin of Korea in the first half of the Middle phase, but there is no evidence for these features before or after. In this way, the use of complex hunter-gatherers as a 'stage' in the unidirectional evolution between simple hunter-gatherers and agriculturalists simply does not fit and may hinder more multifaceted understandings of both forager and food-producing societies in prehistory (Kim and Grier 2006).

We are not suggesting that the investigation of social and political complexity in the Chulmun period is not a worthy endeavor. Over the several millennia of its span, societies of the Chulmun period underwent major changes in terms of scale and geographic distribution of communities, subsistence activities, and interaction and exchange that were almost certainly accompanied by shifts in organizational features. For instance, the formation of large-scale co-residential communities in the Middle phase likely required novel forms of labor organization that involved large portions of the community engaged in mass capture or harvesting of resources (M. Kim 2022). Meanwhile, the rapid dissolution of the large-scale village community and the dispersion of settlements to the mountainous inlands in the Late phase also imply another major shift in the social and labor organization of communities, the potential causes of which must be investigated further. What these trends make clear is that Chulmun social organization was regionally diverse and that it did not remain static or follow a linear trajectory from relatively simple to increasingly complex. As such, identifying indices of complexity or attempting to classify Chulmun societies are perhaps less useful than attempting to model how different social and economic strategies and behaviors may have interacted with organizational configurations both diachronically and between different subregions of Korea.

The Mumun Period

Around 1500 BC, the Korean Peninsula witnessed an abrupt transition in material culture and subsistence practices. The transition to the Mumun period involved the introduction of rice along with an agricultural economy and sedentism, and it is remarkable for showing no indication of continuity with the Chulmun period (J. Kim 2003a). Lithic assemblages, pottery, and dwelling structures bear no resemblance to the preceding Chulmun period, and analyses of toolkits and archaeobotanical evidence together suggest the abrupt arrival of new subsistence practices heavily focused on agriculture. The transition to the agricultural economy of the Mumun period was not characterized simply by the addition of rice cultivation to the predominantly foraging Chulmun plant-use repertoire. Instead, it appears to have been an abrupt replacement as well as abandonment of Chulmun lifeways. With almost no exceptions, shell middens that were regularly accessed to harvest and process marine resources during the Chulmun period lack early Mumun period layers, indicating these locations were no longer accessed after the transition (J. Kim 2003a). The almost complete cessation of the utilization of marine resources is supported by recent isotopic analyses of Mumun skeletal remains, which tend to be recovered from inland burials (Choy et al. 2021). The Mumun material assemblage, consisting of nondecorated Mumun pottery, polished lithic tools such as semilunar reaping knives and daggers, and rectangular longhouses, spread rapidly throughout the peninsula as a package, initially, with little geographic variation. And despite intense investigations over the last 40 years, archaeologists have failed to discover evidence of continuity with Chulmun material culture or examples of contemporaneous Chulmun and Mumun materials (J. Kim 2003a).

Due to the abruptness and discontinuity of the transition and the rapid spread of Mumun material culture and agricultural economy, many archaeologists of northeast Asia have suggested that the transition was a result of a migration of agriculturalists into the peninsula. Following in the culture-history tradition that continues to dominate archaeological research in Korea, many researchers have attempted to identify the geographic origins of Mumun migrants (Ahn 2000; Bae 2006; Cheon 2007; Park 1993). However, these attempts have been largely unsuccessful, relying heavily on subjective comparisons of pottery styles from the sparse archaeological data recovered from North Korea and northeastern China, areas that are nonetheless key to understanding the development of the Mumun economy and material culture. Other have posited models of sustained interaction between indigenous Chulmun hunter-gatherers and Mumun agriculturalists in southern Korea (Ahn 2000; Park 1993), but closer inspection of radiocarbon dates associated with material culture of the two technological traditions failed to reveal any significant temporal overlap (J. Kim 2008a). More importantly, the culture-historical overemphasis on attempting to locate the geographic origins of Mumun material culture and an overreliance on migration as the only explanatory framework have distracted from addressing broader questions, such as how and why the transition from the Chulmun to the Mumun period occurred so rapidly.

One model proposed by J. Kim (2003a) attempts to explain why Chulmun hunter-gatherers abruptly abandoned their subsistence strategy immediately following the appearance of migrant agriculturalists by emphasizing the oppositional land-use strategies of Chumun hunter-gatherers and sedentary Mumun farmers. Whereas logistical mobility between villages and resource-procurement locations appears to have been a vital component of the Chulmun economy (J. Kim 2006a), Mumun villages were likely highly sedentary. J. Kim's (2003a) model suggests that the appearance of sedentary villages established by Mumun migrants interfered and conflicted with the mobility of Chulmun foragers, drastically increasing the costs of logistical access to remote patches and resulting in the rapid collapse of the Chulmun economy. In this view, it was the agricultural Mumun land-use strategy based on sedentary territoriality that disrupted the Chulmun forager land-use strategy based on mobility and the sharing of common-pool resources and led to the incorporation of Chulmun inhabitants into the agricultural economy in a manner that was so rapid that it failed to leave behind traces of interaction.

The Mumun period is divided into three phases. In the Early Mumun (1500–800 BC), dry-field cultivation of millets and newly introduced domesticates, including rice and wheat, was the major subsistence activity, and communities were organized into villages usually consisting of only a few to 10 rectangular longhouses. Although this period is often referred to the Early Bronze Age by archaeologists working in Korea, bronze artifacts dating to this phase are exceedingly rare. In the Middle Mumun (800–400 BC), a new technological tradition called the Songguk-ri Complex (also referred to by Korean archaeologists as the Songguk-ri Culture) appeared in the southwestern part of the peninsula, while in other parts of the country, Early Mumun technological traditions continued to persist. Importantly, during this phase, wet cultivation of rice began, and social complexity increased substantially. The Late Mumun (400–100 BC) is characterized by the flourishment of bronze items. The Mumun period ended around 100 BC when the production and use of ironware began in earnest.

The formation of communities in the sedentary agricultural Mumun society involved complicated processes accompanied by fluctuating population sizes (Fig. 4) and increasing social complexity and thus is a challenging topic to address. While full discussion of various aspects of the Mumun Period is helpful to form a better understanding of these processes, this review focuses mainly on changes in the spatio-temporal distributions of population, including population fluctuation, aggregation, and dissolution. We briefly describe changes in village developments first, and then discuss issues related to these changes and community formation more broadly.

Village Formation in the Mumun Period

The Early Mumun: From Sporadic Hamlets to Villages

Early Mumun settlements may best be described as hamlets in terms of number of dwellings, with settlements generally comprising fewer than 10 pit dwellings sparsely distributed on alluvial plains or small hills. Early Mumun pit dwellings are

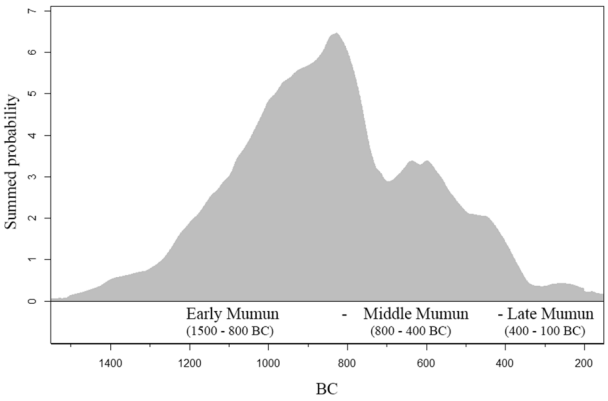

Fig. 4 An SPD of 3453 radiocarbon dates from Mumun dwellings, multiple dates from same dwelling processed as single combined date (ref. to Oh et al. 2017) (rolling mean by 100 years made by rcarbon package in R)

almost without exception long and rectangular with high variability in size, mostly ranging between 20 and 100 m^2, and the largest reaching 250 m^2 in floor area. Many Early Mumun longhouses are characterized by a row of multiple hearths arranged along their long axes, leading some Korean archaeologists to infer that they were possibly occupied by multiple residential groups (S. Kim 2006). Archaeobotanical data indicate that in addition to foxtail millet, broomcorn millet, azuki bean, and soybean, which were cultivated in the preceding Chulmun period, rice and wheat were newly introduced as major cultivars by Mumun agriculturalists (Ahn 2014), but there are regional variations in crop assemblages. For instance, in the central-western region, rice is identified with the highest frequency followed by a significant amount of foxtail millet, and in the southeast, in areas such as Ulsan and Jinju, foxtail millet is more ubiquitous across dwellings in many settlements (Ahn 2014). The frequency of reported cultivars and cultivation fields next to settlements such as the Jinju Daepyeong-ri site suggest that Early Mumun agriculturalists were likely tied to cultivating dry-field plots throughout much of the year (Nam River Excavation Team 1998). Limited-activity stations typical of the Chulmun period disappeared entirely, implying an abandonment of logistical mobility, and virtually all Mumun sites are known from settlements and associated tombs.

An SPD of radiocarbon dates (Fig. 4) and dwelling counts based on traditional typo-chronologies together suggest that the population of Mumun agriculturalists grew rapidly (Ahn and Hwang 2015; Hwang 2014; S. Kim 2023; Oh and Conte 2022; Park 2015). As populations grew over time, spatial reorganization of village populations is evidenced by the appearance of some large-scale villages near the end of the Early Mumun. Approximately 200 pit houses were excavated at the Cheonan Baekseok-dong site dating to late Early Mumun (Chungcheong Institute of Cultural Heritage 2009; Chungnam Institute of History and Culture 2008; Lee and Lee 2000; Lee et al. 1998), implying processes of population aggregation. Similar trends of developing large villages are also observed in other regions, including Ulsan and

Jinju in southeastern Korea and Incheon, Hwaseong, and Chuncheon in central Korea. Some archaeologists have suggested the possibility of emerging craft specialization in some large villages (Bale and Ko 2006). However, despite aggregation toward the end of the Early Mumun, there is little evidence for any increase in social complexity and inter- and intra-village hierarchies or differentiation (J. Kim 2008b). As we discuss below, some of these newly appeared large villages did not last long and were abandoned by the beginning of the following Middle Mumun period.

The Middle Mumun: Aggregation and Formation of Large-Scale Villages

Around 800 BC, a new technological tradition—the Songguk-ri Complex—appeared and spread throughout the southern part of the Korean Peninsula. Songguk-ri-type pit dwellings are invariably circular, lack internal hearths, and are much smaller in size (approximately 20 m^2 on average) than Early Mumun longhouses, and Songguk-ri pottery and lithic assemblages also show a marked departure from Early Mumun assemblages. As a result of the clear distinction between Songguk-ri and Early Mumun material cultures, there has been some debate over the origins of the Songguk-ri Complex. While some archaeologists have sought to locate its origins beyond the Korean Peninsula (Ahn 2019; H.-J. Lee 2002; Lee and Heo 2013), other researchers argue for autochthonous development. For example, the senior author (J. Kim 2003b, 2006b) suggests that the rapid decrease in radiocarbon dates associated with the Cheonan Baekseok-dong site—one of the largest settlement sites in central-western Korea—after 900 BC indicates a decline of the village, perhaps as a result of a population-resource imbalance, that contributed to the spatial reorganization of population and subsequent formation of the Songguk-ri Complex in the southwestern Korean Peninsula. However, the notorious plateau in the radiocarbon calibration curve between 800 and 400 BC, often called the Hallstatt Plateau (Jacobsson et al. 2018; Meadows et al. 2020), makes tracing the detailed processes of the development of the Songguk-ri Complex difficult.

The Songguk-ri Complex has been associated with substantial changes in agricultural production technology as well as rapid growth of social complexity. Paddy fields, which are exceedingly rare before the Middle phase, are found in abundance, mainly in the southern half of Korea (Fig. 1). For example, at the Nonsan Majeon-ri site, terraced rice fields (each field comprises paddies about 40 to 90 m^2) associated with a reservoir and channels were excavated along with Songguk-ri dwellings (Lee et al. 2004). Archaeobotanical analyses also suggest that rice had become increasingly important in many settlements by the Middle Mumun period (Ahn 2014). Nonetheless, some researchers have cautioned that the importance of rice may be overemphasized. Stable isotope analyses carried out on a small number of Middle Mumun skeletal remains seem to suggest that C4 plants, likely millets, also contributed substantially to the diet of some Middle Mumun individuals, while analyses of compound-specific isotopes of lipid residues from pottery indicate that terrestrial animals continued to be hunted into the Middle Mumun (Choy et al. 2021, 2024; Kwak et al. 2017). While these studies are important contributions to understanding the variability of Middle Mumun foodways, they risk underestimating the importance of rice in the Middle Mumun diet, particularly for the southern half of Korea.

Stable isotope analyses (Choy et al. 2021, 2024) were conducted only on skeletal remains of seven individuals from three sites located in the inland central part of South Korea, where archaeobotanical evidence reveals that millets were more ubiquitous, even in the Middle Mumun (Ahn 2014). Furthermore, plant residues are less likely to leave detectable traces in pottery, resulting in an emphasis on animal fats, and thus lipid residue analyses of pottery may often fail to provide a good indicator of past diets and subsistence practices (Dunne et al. 2019). Direct archaeobotanical evidence from the Songguk-ri site suggests that rice was likely commonly consumed by village residents (M. Kim 2015), and regardless of whether it provided the main source of calories across all settlements, the adoption of wet-field cultivation of rice would have also greatly increased overall agricultural production, while also resulting in an increased demand for cooperative labor (J. Kim 2003b, 2006b). As we discuss in more detail below, settlements associated with the Songguk-ri Complex also witnessed a remarkable tendency toward aggregation and clear indications of increasing social complexity and inequality. Although rare in the Middle Mumun, bronze lute-shaped daggers common in northeastern China—called "Bipa-shaped daggers" by archaeologists working in Korea—have been recovered from several burials dating to the Middle Mumun period, and some researchers have suggested that the highly limited distribution of these items indicate growing social inequality (J. Kim 2014a; Yi 2022).

In central Korea, where the material culture of the Early Mumun was sustained, archaeologists have failed to find evidence for paddy cultivation of rice, perhaps suggesting that dry-field cultivation remained the major subsistence activity. Nonetheless, this subregion also experienced substantial growth in settlements, including the recently excavated Chuncheon Jungdo site, which consists of 1273 Mumun dwellings dating from 1200 BC to 400 BC. While the Jungdo site is by far the largest site known in central Korea, the distribution of radiocarbon dates indicates the size of the settlement rapidly increased between about 850 and 750 BC. Despite differences in the material culture and subsistence practices between southern Korea and central Korea, rapid aggregation of Middle Mumun populations is observed in both areas and is thought to relate to increasing social complexity across Korea (see below).

The Late Mumun: Rise of Bronze and Decline of Settlements

The Late Mumun is characterized by the flourishment of bronze goods. Most bronze goods of the Late Mumun have been unearthed from burials and are rarely found within settlements. The quality and diversity of bronze items markedly increased: bronze goods were produced with much improved technology and not only daggers but also bells, mirrors, axes, and other items were interred together as sets. Molds for the production of bronze goods have been found at various sites, in particular in southwestern Korea. Despite the intensive use of bronze items as elite burial goods, suggesting great investment in bronze production and/or trade, it is during the Late phase that the number of settlements and dwellings declined dramatically, an enigma that has puzzled researchers of the Mumun period for years. Although a significant number of burials continue to be reported throughout the phase, the number of settlements and dwellings dating to this period decreased dramatically (Fig. 4). This

same trend is reflected in the number of radiocarbon dates associated with the Late Mumun, suggesting a substantial change in Mumun lifeways (Yi 2022). Various hypotheses can be proposed to explain this phenomenon, but none of these satisfactorily explain the apparent decline of Mumun settlements.

Themes in the Formation of Mumun Communities

Diverse Processes of Community Formation and Growth

The formation, growth, and dissolution of villages are processes closely associated with demographic dynamics, including change in not only the size and density over time but also spatial reorganization of populations. Accordingly, to understand the formation of villages and its relationship with communities, a first step is to explore spatio-temporal dynamics of population. As we briefly stated above, recent applications of radiocarbon dates as a proxy for population change can be an effective tool, although some issues remain debated (Carleton and Groucutt 2021; Crema 2022). Here, we begin with a brief overview of research on population dynamics in the Mumun period. An SPD of radiocarbon dates from Mumun villages indicates significant population fluctuation. Population fluctuation shown in an SPD of 3453 radiocarbon dates from Mumun settlements indicates that a population boom immediately followed the onset of the Early Mumun, population increased rapidly until 900–800 BC, and population significantly declined in the Late Mumun (Fig. 4). Population booms following the transition to an agricultural economy and subsequent population declines have been also detected in other regions of the world including Europe (Shennan 2018; Shennan et al. 2013).

Population fluctuations over time likely led to changes in the spatial organization of populations during the Mumun period. The earliest Mumun villages were not large, rarely consisting of more than 10 dwellings and were scattered on hills and alluvial plains. As populations grew toward the end of the Early Mumun, larger villages comprising 80 to 200 dwellings appeared at some locales. While the large number of dwellings may reflect the long occupation spans of village sites (Chamberlain 2006; Hassan 1981), the aforementioned Cheonan Baekseong-dong site, comprising 192 dwellings, provides an example of a village that aggregated and then declined quite rapidly. Radiocarbon dates suggest a relatively short lifespan of this settlement: the majority of the dwellings were occupied between 1000 and 900 BC (Chungcheong Institute of Cultural Heritage 2009; Chungnam Institute of History and Culture 2008; Lee and Lee 2000; Lee et al. 1998). The distribution of dates indicates that Baekseok-dong was not a large settlement until 1000 BC but rapidly grew to an extraordinarily large size, followed by an abrupt dissolution within a few centuries, by 750 BC. Although the question of why people rapidly aggregated and the settlement grew so abruptly requires further scrutiny, the senior author (J. Kim 2003b, 2006b) suggests that the rapid growth of the Baekseok-dong site drastically raised population density and created a population-resource imbalance and that the village was abandoned within a short span at the end of Early Mumun, leading to spatial reorganization of the population.

The appearance of large villages is more apparent in the Middle Mumun, particularly in the city of Chuncheon in central Korea, Ulsan in southeastern Korea, and Buyeo in southwestern Korea. Research, however, indicates that the processes that gave rise to the growth of these villages were complicated and variable. We compare three different processes of village formation in the Middle Mumun. First, in the present-day city of Ulsan in southeastern Korea, the growth of village size appears to have resulted in village fissioning and spatial dispersion. Ulsan is located in a hilly basin surrounded by mountains, and multiple Mumun village sites are distributed along its hill slopes and valleys. Based on radiocarbon dates, the occupation of this area began in the Early Mumun and population in the region increased steadily, reaching a peak around 900–800 BC followed by a gradual decline (M. Kim et al. 2023; Lee 2008). Aggregation of some form is evident in the largest villages, but it appears, in this area, village residents may have actively prevented overcrowding. Through analyses of the spatial distribution of 468 dwellings at five Mumun village sites in Ulsan, M. Kim et al. (2023) suggest that dwelling clusters were likely contemporaneously occupied and argue that continued population growth during the Mumun Period in Ulsan resulted in the horizontal expansion of settlements, as new dwelling clusters were newly established on the peripheries of older ones. This spatial expansion of dwelling clusters has been interpreted as a form of localized fissioning in order to reduce scalar stress as Mumun villages in the region grew increasingly (M. Kim et al. 2023).

In sharp contrast, aggregation into an established village and population concentration are apparent in central Korea. This change is closely associated with the explosive growth of the Chuncheon Jungdo settlement, located on a riverine islet in the Han River valley. Excavations between 2011 and 2017 revealed 1273 Mumun pit houses, burials, and a ditch enclosure (Joint Excavation Research Team of Jungdo-dong Site 2020), which is the densest distribution of dwellings and other features in the Mumun period yet to be excavated (Fig. 5). The Jungdo site had been occupied

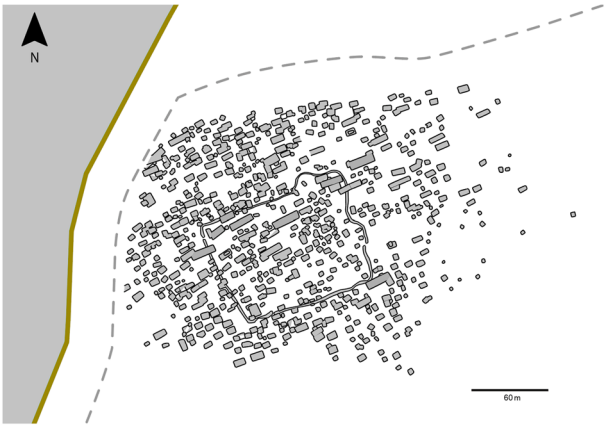

Fig. 5 A partial layout of Chuncheon Jungdo Mumun settlement B and D area, mostly occupied by the Middle Mumun dwellings and a square shaped ditch (edited from S. Kim 2023 with permission from the original author)

since the onset of the Mumun period, and although it was the largest village in the region, it had not reached its peak in terms of number of dwellings, and several other smaller villages and hamlets dotted the area surrounding the settlement. During the Middle Mumun, the number of dwellings at the Jungdo site increased rapidly to more than 600 dwellings dated to a single phase (S. Kim 2023). This explosive growth at the Jungdo site coincided with a substantial decrease in size or total abandonment of neighboring villages and hamlets, strongly suggesting a pronounced and rapid aggregation and concentration of populations from neighboring villages centered on the Jungdo site (S. Kim 2023). While the motivations for substantial aggregation at the Jungdo site—located in an area that allowed little space for spatial expansion—are not known, the potential abandonment of nearby settlements and movement of groups into the Jungdo settlement may represent another unique configuration of aggregation that differs starkly from the fissioning and spatial dispersion of village residents as seen in Ulsan.

In central-western Korea, another unique process of village formation is observed. The Buyeo Songguk-ri site is a typical example. With more than 110 dwellings excavated thus far, it is the largest Mumun settlement in southwestern Korea, and it is thought that the site is much larger. A wide variety of features, including dwellings, storage pits, portions of a palisade wall surrounding the village, a ritual plaza, and multiple burials, including a stone cist burial with a rare bronze dagger, have been identified at the site (Archaeology Center of Korea National University of Cultural Heritage 2015; Museum of Korea National University of Cultural Heritage 2023). One of the most notable characteristics of the Songguk-ri settlement is the spatial division of its features: dwellings, storage pits, and ritual facilities appear to be organized into clusters, occupying different areas of the site. Multiple lines of evidence suggest that the Songguk-ri settlement was an important regional center and that its appearance coincided with an increase in the degree of social complexity in Mumun society (Grier and J. Kim 2012; B. Kim 2005; J. Kim 2008b). For example, sites located on the upper reaches of rivers, such as Gongju Jangseon-ri and Gongju Saneui-ri, consist of only a few pit dwellings but several tens of storage pits. The volume of storage space per dwelling at these sites is extraordinary compared to other villages, and thus, one interpretation suggests that they were specialized storage sites that may have held agricultural surplus for consumption by residents of Songguk-ri (Grier and J. Kim 2012; J. Kim 2008b, 2014a). The discovery of a Bipa-shaped bronze dagger from a prominently placed stone cist tomb at the site is also significant. These bronze daggers are rarely found in Mumun period Korea but were widely distributed in contemporaneous northeast China, perhaps suggesting the establishment of long-distance networks managed by elites (J. Kim 2014a). Despite continuous excavations since 1975, evidence for Early Mumun occupations have yet to be found, perhaps suggesting that Songguk-ri, unlike Chuncheon Jungdo, was a planned settlement constructed in an area that had previously been unoccupied (J. Kim 2006b).

These three cases suggest that aggregation was a common phenomenon in the Middle Mumun, but the processes of aggregation were diverse, including village fission followed by the establishment of offshoot clusters, resulting in a high degree of spatial dispersion in Ulsan; rapid aggregation in an already-established large village

and simultaneous abandonment of nearby villages, as in the case of Jungdo; and the establishment of a planned regional center in an area that had been previously unoccupied at Songguk-ri.

Multilayered Communities

Although these diverse trajectories of village formation and growth would have led possibly to diverse processes of community formation, it is difficult to assume a straightforward relationship between the two processes. As we discussed above, villages detected in the archaeological record are spatial clusters of dwellings, which should be distinguished from a community. Community is defined or perceived differently depending on the context, culture, and individual, and thus, cannot be directly equated to the village (Yaeger and Canuto 2012). Villages may consist of households with different identities or result from temporal aggregation on the one hand, while community may also be a larger unit comprising residents of multiple villages on the other hand. An individual may belong to multiple communities on various scales, such as participating in one community on an economic basis, while also participating in another one on the basis of shared ideology. Some communities are defined by everyday interactions, while others are defined by infrequent and loose interactions but a wider, and perhaps even stronger, sharing of identity. In the Mumun period of Korea, which witnessed the appearance of fully sedentary villages and a substantial population increase, community formation would have been a complicated process. Understanding community during the Korean Mumun period accordingly requires the exploration of the layers of complexity inherent in community formation. The manifoldness of community is likely to have been associated with the diverse nature of interactions in each layer. Although it is still risky to simplistically identify the nature of interactions from the archaeological record and diverse interactions are intertwined in complicated ways, economically and ideologically motivated interactions can be heuristically distinguished. Between the two, the economically motivated interactions tend to be related to the production, distribution, and consumption of goods and resources, and units of these activities may provide clues.

As stated above, Early Mumun dwellings were rectangular longhouses with multiple internal hearths. While mostly ranging between 20 and 100 m^2, some Early Mumun longhouses were as large as 250 m^2. From their size and the presence of multiple hearths, some Korean archaeologists infer that Early Mumun longhouses were occupied by more than one nuclear family/domestic group (Ahn 2006; S. Kim Kim 2006; Lee 2009). Storage pits were usually located inside houses and exterior storage facilities are very rare, suggesting that agricultural products were stored inside each dwelling under the control of individual households (Grier and J. Kim 2012; J. Kim 2008b), although it is unclear whether individuals residing in a single dwelling constituted a household. However, if we assume that the dwelling of the Early Mumun was occupied by a household, then households were likely both a labor mobilization unit for agricultural production and a consumption unit for resources produced (Grier and J. Kim 2012).

Wet-field cultivation of rice was part of the Songguk-ri Complex, which emerged at the onset of the Middle Mumun in southwestern Korea. Coupled with the discovery of multiple paddy fields associated with the complex, comparisons of the volumes of storage facilities from the Early and Middle Mumun phases show a marked increase in the amount of food resource surpluses that could be stored per area of habitation by the Middle Mumun (Grier and J. Kim 2012; J. Kim 2008b). Besides transformations in agricultural technology and practices, remarkable changes in the organization of households and residents are also observed in the Middle phase. Dwellings associated with the Sogguk-ri assemblage are round and significantly smaller, averaging less than 20 m^2 of floor space. Another important distinction is that Songguk-ri dwellings lacked any form of internal storage facilities, whereas Early Mumun longhouses consisted of storage pits in their interior. In Songguk-ri villages, storage facilities are instead located outside dwellings and usually occur in clusters, and in many settlements, these clusters of storage pits are located distantly from individual dwellings and groups of dwellings. In addition, nearby are contemporaneous, potential specialized storage sites (Ahn 2004; Grier and J. Kim 2012; J. Kim 2008b, 2014a).

The disappearance of internal storage facilities may have had to do with the decrease in size of dwellings, but this transformation may also hold socioeconomic significance as well. For example, it has been argued that the location of storage pits distant from individual dwellings and dwelling clusters suggests that control of agricultural products shifted from the hands of individual households as private goods to the realm of communal goods that were produced, distributed, and consumed collectively at the village level (Grier and J. Kim 2012; J. Kim 2008b, 2014a). Indeed, paddy cultivation of rice is labor intensive and requires the production and maintenance of paddy fields and irrigation, which would often exceed the labor supply of the individual household and instead require communal labor consisting of members of multiple households (Grier and J. Kim 2012; J. Kim 2008b, 2014a). As such, members of communal labor groups would potentially have shared rights to consume agricultural products, resulting in a community based on economic labor. Communal storage that involved pooling and redistribution of stored surpluses above the household level can serve as a mechanism to redistribute and share agricultural resources among households to level wealth disparities, potential inequalities, and/or promote social cohesion. However, as we discuss in greater detail below, inequality appears to have increased—not decreased—in Songguk-ri society.

It appears that the production and consumption unit changed from household to village, as labor-intensive agricultural production technology was adopted in the Middle Mumun period of southwestern Korea, although it is unclear whether this was also the case in central Korea where evidence for paddy farming has not been discovered. While the production/consumption unit cannot be directly equated with an economic community, labor pooling for daily subsistence activities, collaborated production, and sharing of agricultural products would have created opportunities for regular, face-to-face interactions among village residents, potentially serving as one layer of community.

While the economic unit would have possibly constituted a layer of community, there were likely other layers of community in which individuals interacted and

shared other kinds of identities. Early Mumun households and Middle Mumun villages provided an economic community for collective production and consumption of agriculture products, but there also is evidence suggesting the existence of larger levels of community that went beyond the bounds of the household or village. One of the rationales for this argument is the construction of dolmens, which began in the middle of the Early Mumun, more than 50,000 of which have been recorded and reported in Korea (Chi 1982; Jo 2004; Y. Lee 2002). Dolmens were used as burials and consist of an underground burial structure and capstone placed on the burial structure. The size of dolmens varies but capstones usually weigh between 5 and 25 tons (Y. Lee 2017). Calculations and experiments suggest that more than 50 people would have been required to construct dolmens with a capstone weighing 10 tons (Lee 2003). Regardless of the accuracy and reliability of this calculation, the substantial labor requirements, and the size and number of dwellings in many of Early and Middle Mumun settlements (except some large-scale villages) indicate that there would rarely have been more than 50 adults in each village (J. Kim 2002; Song 2001), leading archaeologists to suggest dolmens must have required mobilization of a substantial labor force, perhaps on a supra-village scale (Choi 1991; J. Kim 2014a). Archaeologists in the 1980s argued that the large-scale labor investment in dolmen construction implies that they were built as burials for prominent powerholders (Choi 1991), but there are simply far too many dolmens in the region for them to be considered burials reserved for only a few members of the elite. In addition, burial goods interred in dolmens are either absent or, if present, at best rather poor, consisting of a few utilitarian stone tools and potsherds. Thus, this argument is no longer accepted by many archaeologists in the 21st century. Although the social roles of the dolmens are still not well understood and archaeologists are uncertain why labor was mobilized for dolmen construction on a supra-village scale, it is likely that the mobilization of labor for the construction of dolmens threaded members of multiple villages into a common community identity (J. Kim 2014a).

This view of the Mumun supra-village community is further supported by analyses of important yet commonly recovered nonutilitarian wares, known as red-burnished jars, from scatterings of small villages in the Namhan River valley (such as Pyeongchang Yaksu-ri, Yeongwol Jucheon-ri). One study found that red-burnished jars recovered from different villages were geochemically distinct, suggesting that they were produced locally. However, in terms of design and form, the red-burnished jars also were remarkably similar across all villages, suggesting that form, design, and production techniques were shared closely among villages and may have played a role in maintaining a shared identity among multiple villages (Boo 2022).

Although identifying various levels of communities, which are multilayered and ever-changing, proves challenging, it seems that Mumun communities consisted of multiple layers. Individual households (Early Mumun) and villages (Middle Mumun) were economic units that independently produced and consumed food resources collectively and labor for agricultural production was mobilized collectively. Despite changes in scale over time, economic units would have constituted one layer of community in which interactions associated with daily production and shared consumption took place. Meanwhile, there was a higher level of community in which multiple villages participated. Labor for dolmen construction was likely

mobilized from multiple villages that shared some identity, and perhaps nonutilitarian goods, such as the red-burnished jar, served as a medium for maintaining community identities shared across multiple villages.

Scalar Stress and Social Complexity

Another issue that must be considered in understanding community in relation with the formation and growth of villages is control of scalar stress. As many previous works have suggested, aggregation and increased population density often result in scalar stress and population-resource imbalances; thus the sustainability of large villages often relies on how to reduce and control scalar stress, while failure to reduce scalar stress may result in the dissolution of large villages and communities (Bandy 2004; Johnson 1982; Smith 2019). For hunter-gatherers of the Chulmun period, mobility would have provided an effective, viable strategy to suppress scalar stress, but fully sedentary Mumun agriculturalists experiencing significant population growth would have required strategies for mitigating scalar stress. The strategy for controlling scalar stress is important for understanding community formation in that scalar stress is not only size and density-dependent but also an interaction intensity-dependent phenomenon, which is a key component of community formation.

The rapid aggregation of the Cheonan Baekseok-dong settlement in the Early Mumun period would have drastically increased scalar stress and population pressure. Subsequent abrupt dissolution of the village within a few centuries strongly suggests that village members failed to develop a strategy for mitigating increasing scalar stress (J. Kim 2003b, 2006b). By contrast, in the Middle Mumun, a period in which aggregation became more pronounced, a variety of stress-reduction strategies can be detected, which took on many forms. Fissioning and decreasing village density were likely strategies taken up by village residents in the Ulsan area (M. Kim et al. 2023). At Jungdo in central Korea, where the location of the settlement on a small islet made spatial dispersion more difficult, increasing residential density would have been unavoidable, and residents may have sought other means of ameliorating its effects. For instance, variations in dwelling size, tool assemblages, and pottery decoration drastically decreased following aggregation at the Jungdo settlement, which may point to another type of leveling mechanism, one in which households deemphasized any form of differentiation in favor of an egalitarian ethos (S. Kim 2023).

At the same time, the Middle Mumun also saw growth in social complexity and inequality, including the exclusive use of bronze goods by elites, and also other craft goods such as greenstone ornaments in southern area (Bale and Ko 2006; Lee and Bale 2016). The aforementioned Bipa-type bronze dagger, extraordinarily rare in southern Korea but common in northeast China, was likely a symbol of a supra-regional elite exchange network as well as a political tool for distinguishing elites from commoners (J. Kim 2008b, 2014a). Furthermore, the communal production and consumption of agricultural products as communal goods in Songguk-ri settlements may have led to a "tragedy of the commons" (Hardin 1968), leaving opportunities for the emergence of elite individuals or groups that take on managerial roles in the redistribution of surplus. And of course, it is possible that such surplus

resources were not distributed evenly among households and some degree of appropriation occurred. The exclusive use of bronze and its placement in certain tombs suggest that the superiority of a small number of community members (i.e., elites) was pronounced (Grier and J. Kim 2012; J. Kim 2014a). Importantly, leveling mechanisms among community members (homogenizing ideologies, which may distract community members from being more cognizant of inequalities) and the distinction between elites and commoners (distinction ideologies, which naturalize inequality) were not necessarily incompatible in the Middle Mumun; both can coexist as dual strategies to maintain communities and the sociopolitical order.

Another issue that requires further scrutiny is the extreme scarcity of settlements in the Late Mumun period. In the Late Mumun, the Korean Peninsula saw a flourishment of bronze goods, as the quantity, diversity, and technology of bronze goods increased substantially. Bronze goods of the period are typically discovered in elite burials or ritual contexts, indicating that elite use of bronze goods for sociopolitical and ideological purposes was more intensified in the period. However, very few settlements dating to the period have been found despite continuous efforts to identify them. Late Mumun pottery has been unearthed only from either burials or ditches, rather than dwellings, and the number of radiocarbon dates falling into this period also are substantially fewer. A variety of hypotheses can be proposed to explain this phenomenon, including the spread of epidemics, warfare, collapse of economy, environmental deterioration, fundamental changes in dwelling construction technology that decrease the archaeology visibility of settlements, and large-scale migration to Japan. Nonetheless, a dearth of data relating to human occupation accompanied by a massive increase in elite burials and bronze goods make it difficult for Korean archaeologists to test any of these hypotheses. The Late Mumun enigma will, therefore, remain an important problem that must be addressed in the future.

Discussion

Community Formation in the Chulmun and Mumun Periods

The long process of the emergence, growth, and dissolution of villages during the Chulmun and Mumun periods spanning 6200 to 100 BC was a consequence of a dynamic interplay between various environmental, physical, and economic factors. These factors were ever-changing over time and posed differing constraints and opportunities to individual decision-making units, creating various costs and benefits of staying versus moving (Feinman and Neitzel 2023). It should be noted that, while individual units' assessments of costs and benefits may vary and can be independent, one's decisions regarding affiliation and interaction are affected by others' decisions, and thus, decision-making processes are inherently social and interactive. Decisions are not limited only to the question of whether to affiliate but also include when, how long, where, and in what forms to interact with others, and the emergence, growth, and dissolution of villages and associated communities can be viewed as the aggregated consequence of such decisions. Among numerous factors

that affect these decisions, we focus on demography and access to resources, which include not only economic but also sociopolitical resources.

The first villages in prehistoric Korea, marked by the appearance of multiple occupied dwelling features, appeared in the Early Chulmun period. Archaeologically, this is a significant development in itself. Although such social configurations likely reach much further into the past, the archaeological discernment of the dwelling as a socio-spatial unit, within a village comprising multiple dwellings, allows for the recognition of a nested organization consisting of the co-residential household occupying the dwelling and the co-residential village, which likely, to some degree, operated as a cooperative unit. In the Early phase of the Chulmun period, the relatively small number of known village sites and excavated dwellings makes it difficult to interpret the overall scale and the social relationships that characterized these village communities located almost exclusively on islands and along the coastline, but the presence of many expansive and temporally continuous refuse middens suggests that village members engaged together in a wide range of activities, perhaps as small but cohesive economic and social units, that were closely tied to the maritime landscapes along the southern and eastern coasts of Korea.

The scale of the village increased dramatically in the Middle Chulmun, as villages comprising several tens of dwellings began to appear in the western half of Korea. This represents an increase in the number of community members residing within the village, implying a greater concentration of interaction in terms of resource sharing, communal labor and activities, sharing knowledge, and learning. At the same time, the Middle Chulmun large-scale villages also seem to have been characterized by a high degree of fluidity in terms of organizational structure and the residential permanency of their residents. Movement to and from the coast, in some cases from sites located more than 50 km inland, is evidenced by the large number of contemporaneous shell middens on Korea's western coastline and close-lying islands. Subsets of the large village communities—whether individuals, nuclear households, kin groups, specialized task groups, or combinations of these—would have left the village frequently and potentially interacted with other visitors to the limited-activity stations from other villages. And while it is unclear how cohesively the large Chulmun village community functioned as a socioeconomic unit, the tendency of smaller subsets of the village community to come and go, engage independently in resource acquisition, and interact and exchange with members of other village communities may have been a key factor that permitted the emergence and continuity of the large-scale village community. Logistical mobility undertaken by subsets of the larger village community would have diversified resources available to village members by expanding the foraging range and types of resources that could be acquired. This would have allowed for the acquisition of a wider variety of resources in a landscape that is characterized by diverse ecosystems and dramatic seasonal fluctuations in resource availability (Conte 2019; J. Kim 2003a, 2006a; M. Kim 2022). In addition, the diffuse allocation of resource-acquisition activities among multiple subgroups would have also acted as a safeguard against failed foraging forays among individual groups, and by the same token, even short-term or seasonal forays undertaken by subsets of the village community would have likely eased many of the stresses associated with continuously interacting village aggregations, including social conflicts

and competition over resource and/or cultivation patches. Mobile subsets of the village group would have linked the spatially bounded village community with other village communities throughout the region, but large portions of the community could also be marshaled for larger-scale labor undertakings, such as the operation of mass-capture technologies, when required.

Given these potential benefits, the question of why these relatively large-scale Chulmun villages were not sustained for longer becomes more intriguing. One of the characteristics of the Late Chulmun is that the disappearance of large villages coincided with an increase in the number of open-air hearths with no substantial occupation (Ahn and Hwang 2015). These changes may reflect a shift in the costs and benefits of affiliation among village members, although the reason for this shift is uncertain. Population decline has been put forward as one possibility, but whether populations actually declined or have simply left behind less material evidence as a result of more frequent mobility is currently debated (Ahn et al. 2015; Lim 2008). It is also possible that villages simply grew too large to remain socially and economically sustainable, leading to increases in scalar stress and competition, but fissioning into new village communities would likely result in new daughter villages that eventually grew in scale rather than the total dissolution of the large-scale villages into very small co-residential groups. Resource depression as a result of environmental change has also been posited as a potential driver (e.g., Ahn et al. 2015; Park et al. 2021), but these proposals rely on only a few localized proxies and fail to provide comprehensive paleoenvironmental data to support regionwide changes in climate and vegetation. Although multiple variables potentially interacted to lead to the dissolution of large-scale village communities in the Chulmun period, more attention should be given to possible changes in food-resource acquisition and production practices, which have, thus far, been assumed to have remained largely static throughout the period, in order to understand how these may relate to changes in the size and organization of Chulmun village communities. We must also be careful not to equate the dissolution of the large-scale village with the dissolution of community. Rather than wandering pristine landscapes devoid of sociality, highly mobile foragers have been found to continuously aggregate and disperse, often moving between multiple camps that cross-cut co-residential groups and affiliations (Bird et al. 2019). Unique interactions over the lifetime of individual mobile foragers have been estimated to number in the several hundreds—often outnumbering the population of the co-residential group by order of a magnitude—and these interactions play an essential role in the transmission and accumulation of knowledge, sharing of ideas and goods, and maintenance of distant kinship ties, forming complex communities that are spatially dispersed and temporally cumulative (Hill et al. 2014). Although further scrutiny and more refined analyses are required, the decline in intra-village interaction in the Late Chulmun can be seen as a significant alteration of affiliative decisions regarding not only whether to stay or move, but also how to interact with others.

The abrupt transition to agriculture and the explosive population increase since the onset of the Mumun period would have created a venue for interaction that differed from the previous Chulmun period and new cost-benefit relationships of affiliation and interaction. Above all, compared to hunting and gathering, farming is a

subsistence activity that tethers people to land and constrains frequent moves. The Mumun crop assemblage consisted of taxa that required attention throughout much of year, including rice, wheat, barley, millets, and legumes. Although there is evidence for continued fishing and hunting (Kwak et al. 2017), the labor demands of field clearing, sowing, tending, and harvesting would have precluded a frequently mobile lifestyle. The majority of villages of the Early Mumun were relatively small, particularly compared to those of the Middle Mumun period, but unlike Chulmun villages, the formation of villages in this period would have led to a substantial increase in the frequency and intensity of day-to-day interactions within villages, where co-residential groups were tethered to the village as a consequence of a commitment to plant-food production. It can be inferred that the majority of day-to-day interactions occurred between members of the co-residential village community, and perhaps more intensely between household members. While the composition of the longhouse dwelling unit of the Early Mumun is not clear, the presence of internal storage pits and large jars within dwellings suggests that the co-residential dwelling group stored and accumulated goods within the dwelling, which may indicate that the extended dwelling group was a closely tied economic community within the larger community of the hamlet. The adoption of farming and consequent reliance on immobile resources may not have directly increased the benefits from affiliation but led to significant increases in the cost of isolation from not only land but also village in the Early Mumun.

Population continuously increased during the Early Mumun period. The demographic change was not limited to the size but was accompanied by spatial reorganization of the population. Aggregation and the emergence of large villages are observed toward the end of the Early Mumun period, and this tendency became even more pronounced in the following Middle Mumun period when villages comprising hundreds of dwellings became increasingly common. One of the most apparent consequences of rapid aggregation would have led to a substantial increase in the frequency and intensity of face-to-face interactions and intra-village scalar stress and competition (Ortman and Coffey 2017; Smith 2019). The sustainability of an aggregated village largely depends on whether and how scalar stress is mitigated. In the absence of strategies to mitigate scalar stress, aggregation increases the cost of affiliation and eventually leads to dissolution of the village. For example, at the Cheonan Baekseok-dong site, a large village dating to the later phase of the Early Mumun, aggregation was not long-lasting. Radiocarbon dates from the site are densely concentrated between 1,000 and 900 BC, after which the village was apparently almost abandoned, likely as a result of a population-resource imbalance, increasing scalar stress, and probably an absence of mechanisms for controlling the stress (J. Kim 2003b).

Large villages that appeared in the Middle Mumun, unlike at Cheonan Baekseok-dong, seem to have developed stress-controlling strategies to some degree. The processes behind the development of aggregated villages in the Middle Mumun varied: fission and spatial expansion (among villages in the Ulsan Basin in southeastern Korea), the construction of a planned village in a previously unoccupied area (Buyeo Songguk-ri in southwestern Korea), and the abandonment of hamlets and subsequent population concentration in a large village (Jungdo in central Korea).

The processes of village development observed in the Ulsan Basin and at Songguk-ri can be viewed as strategies for lowering population density and controlling the size of residential clusters. However, concentration at Jungdo following the abandonment of hamlets in its vicinity would have required some means of ameliorating scalar stress arising from the ever-increasing density of residential units in the village. The aggregation of residents originating from neighboring hamlets to the settlement at Jungdo would have likely been encouraged by some forms of benefits, although the benefits afforded to individual decision-making units are unclear. Since the site was located on a riverine islet where spatial expansion or fissioning may have been limited by geography, other mechanisms of managing growing concentrations of residents would have been required. As S. Kim (2023) demonstrates, following the phase with the largest increase in residential units, there was a significant decrease in the diversity of house size and household assemblages, which may suggest some forms of leveling mechanisms and/or the rise of an egalitarian ethos to mitigate scalar stress. In other words, the sustainability of large, aggregated villages was viable only when strategies for controlling scalar stress were developed, and failure to develop such mechanisms would have led to increasing costs of affiliation and, eventually, the dissolution of the village, as seen at Cheonan Baekseok-dong.

As Feinman and Neitzel (2023) suggest, the effectiveness and stability of mechanisms for ameliorating scalar stress must be socially institutionalized and embedded. We suggest that the leveling mechanisms detected at Jungdo are likely to have been established as a social institution to control the scalar stress ideologically. In this sense, it is not surprising that aggregation and the development of social institutions in the Middle Mumun coincided with a substantial increase in social complexity, which included the diversification of communities and the incipient development of hierarchy. Although the archaeological evidence is still fragmentary, it is apparent that there were at least two levels of communities during the Middle Mumun: the village as an economic community in which communal production, storage, and consumption occurred; and the supra-village community in which broader identities were shared by multiple villages. The development of both levels of community identity likely relate closely to increasing socioeconomic and ideological complexity, cooperation in subsistence and other economic activities, and institutionalized interactions between communities as villages became more densely distributed in the Middle Mumun period.

The increasing scale of paddy cultivation, evidenced by large paddy fields discovered on the peripheries of some large-scale villages, would have had significant consequences for the size and organization of Middle Mumun communities that would have given way to new community dynamics in which large co-residential groups—even large portions of the village community—were intimately bound together in communal labor. In contrast to the Early Mumun, when the household was the primary unit of production and consumption, residents of the Middle Mumun village community would have spent planting and harvesting seasons cooperating closely to prepare fields for planting, tending crops, and harvesting, processing, and preparing them for storage, evidenced by the disappearance of intra-house storage facilities and the coincident appearance of communal storage facilities in Songguk-ri villages. These large-scale communal investments

may have brought about new systems of surplus management, one in which crops were communally stored and possibly distributed among community members (Grier and J. Kim 2012; J. Kim 2008b, Kim 2014a), suggesting that all community members shared cooperative ownership over these subsistence goods, at least conceptually. Thus, in stark contrast to the preceding Chulmun period and Early Mumun, the large-scale Middle Mumun village had become more-or-less economically self-contained, and cooperative labor, exchange, and interactions among large numbers of village residents fulfilled the basic economic and social necessities of the community members. The residents of the large-scale Middle Mumun villages were, in other words, not only tethered to their villages but also tightly tethered to one another not only in terms of production but also accumulation, consumption, and reproduction.

At the same time, many lines of evidence suggest increasing supra-village interaction, and this level of interaction was likely to lean more on ideological bonds. The widespread distribution of formally similar, but locally produced, red-burnished jars thought to have been used in household and/or communal rituals across Mumun villages point to the sharing of ideologies and ritual practices across multiple villages (Boo 2022). Furthermore, supra-village-scale labor mobilization for the construction of dolmens across the entire Korean Peninsula implies that, regardless of their social functions, some level of identity likely encompassed multiple villages. It is possible that the formation of some sort of shared identity, even if intangible, that linked village communities with others is both inevitable given that interactions will eventually occur between members of tightly distributed, neighboring villages but also necessary in order to facilitate insurance networks and exchange between individuals and groups that are otherwise largely confined to their respective village communities on a day-to-day basis.

The emergence, growth, and dissolution of villages and communities in the Mumun period were related closely to not only changes in the costs and benefits of affiliation but also the development of social institutions. The adoption of farming in the Early Mumun was likely to have substantially increased the costs of moving, compared to the previous Chulmun period. As population increased, aggregation took place in late phase of the Early Mumun, but the failure to develop strategies for controlling scalar stress ensured that aggregation did not last long, as seen at Cheonan Baekseok-dong. In contrast, aggregation in the Middle Mumun was accompanied by the development of strategies that mitigated scalar stress, tension, and competition. We suggest that some of these strategies gradually evolved into social institutions, including communal production and consumption, ideologies such as leveling mechanisms and an egalitarian ethos, and the emergence of leadership and status distinction. They also included the diversification and complexification of community at not only intra- but also supra-village levels, facilitating affiliations with wider networks. It is apparent that the development of social institutions significantly raised the cost of not affiliating with others, although it may not have directly increased the benefits enjoyed from affiliation. As these institutions became consolidated, the autonomy of affiliative decisions of individuals would have decreased, and some forms of community membership would not have been based on individual decisions but rather ascribed.

Methodological Considerations

As Yaeger and Canuto (2012) note, the nature, roles, and scales of communities have continuously changed over time and vary with culture. In any given society, multiple communities may coexist at various scales, and individuals will have different perspectives of how they do, and do not, self-identify—and are also identified—with particular communities. If this inherent subjectivity and fuzziness leads to many ontological and epistemological difficulties in defining communities of the present, these problems are only exacerbated when we attempt to define communities of the past through the use of archaeological data alone. Although we have reviewed recent archaeological achievements on community formation in the Chulmun and Mumun periods, many key issues remain unaddressed. In particular, more attention should be paid to methodologies in studies of community formation in Korean prehistory. Among others, we focus here on two issues that we believe provide important avenues of inquiry for researchers of the prehistory of Korea: the archaeological detection of interactions, and the relationships between the formation of community and that of the village. The former is a more epistemological challenge, while the latter is more practical. As community is an arena of interaction among its members, critical to exploring community formation is the detection of the nature, intensity, and regularity of interactions (Yaeger and Canuto 2012). While archaeology in the 1970–2000s often conflated interaction with exchange or trade, interaction is a much more complicated concept, making it more difficult to detect archaeologically. Exchange and trade, regardless of whether its motivation is economic or sociopolitical, can be identified relatively directly from archaeological data. But this is not the case with the more conceptually comprehensive interaction, and like identity, interaction is a concept that may not be tangibly identified from archaeological data. It is reasonable to assume that residents of a village engage in increasing face-to-face interactions as the number of residents grows (Feinman and Neitzel 2023; Ortman and Coffey 2017; Smith 2019), but the relationship between increased population density and intensification of interaction is not always straightforward. Temporal aggregation of mobile populations might not necessarily result in the intensification of interactions and scalar stress, as residents can disperse as they confront increasing scalar stress. In contrast, when it is difficult to disperse or the cost of not affiliating is high, scalar stress must be mitigated, and this response will change the nature and intensity of interactions among residents. In other words, how scalar stress is mitigated in a village will affect the intensity of interactions between residents, and consequently, how community members define their communities.

As with community, interactions can take diverse forms on various scales. In some cases, economically motivated interactions are distinguished from ideological interactions, but in other cases, boundaries between the two may often be blurred. Some interactions take place on an intra-village level but others on supra-village or sometimes regional levels. Furthermore, the intensity, frequency, regularity, and motivations of interactions are ever-changing and spatially variable. Various forms of identity shared by community members or used to differentiate themselves are important factors that also affect interaction, but identities also are variable and in constant flux. If it is difficult to directly detect interaction due to its inherent

manifoldness, archaeologists must develop indirect approaches to investigating community. As we have reviewed, many recent works on community formation in Korean prehistory consider the emergence of villages and population aggregation to explore changing relationships between village and community. Villages cannot simply be abandoned in the archaeological pursuit of exploring past communities, although community should not be confused with a spatial cluster of households (Birch 2014; Yaeger and Canuto 2012). Without considering how villages emerge and change over time, we believe, it is difficult to address issues related to community formation, and thus investigating the processes behind village formation may provide a tactical starting point to begin to understand community formation and change. By tracing the changing relationships between individuals and groups within and between villages, researchers can gain valuable insights into understanding how factors including mobility and sedentism, social and labor organization, and ideological behaviors and practices may shape who interacted with whom, how often, and for what purpose. Accordingly, we regard the formation, change, and dissolution of the village as necessarily playing a key role in interpreting the dynamics of community in prehistoric Korea.

Nevertheless, the exploration of village formation processes as a tactic for understanding community formation still leads to practical issues of interpretation, namely the trap of equifinality faced by all archaeologists. For example, rapid aggregation is often indistinguishable from long-term internal population growth, and the two processes can occur simultaneously. Even estimating village population sizes and rates of growth and decline can be difficult archaeologically, given that it is not easy to define and demonstrate occupational contemporaneity. As such, archaeological investigations of village formation also rely on understandings of the lifespans of villages, which can be heuristically understood as comprising linked phases of growth, peak, and decline but often involve complex processes that occur across varying durations. Numerous methods based on diverse assumptions have been proposed to infer the lifespan and formation process of village (Chamberlain 2006; Gallivan 2002; Varien 1999), but few of them have been proved to have general applicability.

Studies investigating community formation in the prehistory of Korea have also grappled with these same issues, examples of which may prove to have a more generalizable applicability, and some works deserve consideration. M. Kim (2022) adopts density-based spatial clustering of applications with noise (also known as DBSCAN) to identify co-residential clusters within large-scale Chulmun sites, such as Incheon Unseo-dong. Results of these analyses suggest that residents of Incheon Unseo-dong were likely organized into multiple, discrete dwelling clusters consisting of no more than six households. This insightful work provides an important challenge to the conventional assumption that dwelling counts correlate with village population size. However, it also has limits. As with multivariate cluster analyses, methods such as DBSCAN inevitably generate spatial clusters in any distribution of samples and, perhaps more importantly, provide no means of interpreting such clusters (Shennan 1997). It is unclear if the clusters generated by the analysis represent differences in the temporal occupation of the dwellings, functional or social differences between their residents, or anything at all. Secondly, and perhaps more importantly, it needs to

consider basic chronological information, such as radiocarbon dates associated with dwellings. Without support from reliable chronology, it may fail to recognize whether the clusters are representative of contemporaneous yet differentiated dwelling clusters or palimpsests of multiple occupations spanning a long period of time. Nonetheless, a more careful analysis that attempts to consider the overall duration of the village and potential differences in the timing of the occupation of individual dwellings within and between clusters could potentially utilize this approach to investigate the population and duration of villages throughout their lifespans.

Recent applications of radiocarbon dates for inferring demographic dynamics may also provide a promising tool for estimating population change and reconstructing the life cycle of past villages. One such study was carried out analyzing hundreds of radiocarbon dates from dwellings at Chuncheon Jungdo, the largest known Mumun village site, and several neighboring village sites (S. Kim 2023). S. Kim's (2023) analysis suggests that a significant increase in the number of dwellings at Chuncheon Jungdo corresponds with a simultaneous decrease in radiocarbon dates from neighboring villages at around 750 BC. In addition, the large number of radiocarbon dates from Chuncheon Jungdo allowed for a more detailed reconstruction of history of the spatial expansion of dwellings during this period of rapid aggregation. One novel contribution of this study was the use of bootstrap resampling to mitigate sampling bias in estimating the occupational duration of Chuncheon Jungdo (S. Kim 2023). And although sampling biases in the radiocarbon data arising from differential preservation or selective sampling of certain features data cannot be removed entirely, the study provides an alternative research strategy for inferring the formation processes and lifespan of large-scale villages when radiocarbon datasets are sufficiently large. Future studies may further refine this approach by taking into consideration the duration of individual dwellings in order to provide better estimates of the number of contemporaneously occupied residential units and village population at any given time slice. Despite limitations, such novel attempts to make use of the vast amount of published data provided by archaeological investigations over the past few decades are immensely important not only in spurring efforts to better understand the formation of villages and their potential relationships to community dynamics in prehistoric Korea but also in advancing archaeological research in the region.

Final Remarks

Culture-historical archaeology remains the dominant approach in the archaeology of northeast Asia, including China, Japan, the Russian Far East, and Korea. Despite some variations in research traditions across countries, pottery typology is usually employed to construct chronologies and trace the origins of diffusion and migration. Research questions rarely extend beyond this conventional framework. Settlement formation processes and patterns, as well as their potential relationships to communities, have yet to become major focal points for archaeologists in the region. Instead, typological approaches have been further applied to the form and structure of dwellings, as well as ceramics and lithics, leaving many important archaeological questions unaddressed.

Another significant challenge in the study of community formation in this region is the disparity in the intensity, resolution, and methods of investigation and interpretation between countries. As many archaeological and historical studies have shown, the process of community formation is deeply influenced by supra-regional sociopolitical and economic interaction networks, as well as demographic changes. For example, irrespective of the validity of world systems theory (Wallerstein 2004), many studies have demonstrated that the expansion of the Roman and Inka Empires led to various reactions of local communities, including not only the assimilation of local communities but also their consolidation and diversification (Dietler 2010; Ghisleni 2018; Hastorf 1990). In northeast Asia, the expansion of Chinese polities and their political and diplomatic policies had profound influences on peripheral pre-state communities, which are well documented in historical records. However, archaeologists in northeast Asia rarely consider this aspect. Many interpretations of prehistoric community formation in the region are shaped by nationalism, leading to the neglect or overemphasis of supra-regional interactions and their impact on local communities. Significant differences in the intensity of investigation across countries, combined with the lack of archaeological data from the northern half of the Korean Peninsula, further complicates efforts to provide comprehensive explanations of supra-regional interactions and their role in community formation.

Although a detailed review of archaeological work in neighboring countries is beyond the scope of this discussion, current research in Korean archaeology reveals a slow but steady trend toward a greater focus on community formation in prehistory. However, much of this work is published primarily in Korean, limiting its accessibility and evaluation by the broader archaeological community. By introducing some of these studies and discussing both their potential and limitations, we hope to encourage future archaeologists in this region to share their findings more widely. This will not only contribute to a broader understanding of community formation in northeast Asia but also foster dialogue that extends beyond the region.

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