# The Hunting Farmers

## Understanding ancient human subsistence in the central part of the Korean peninsula during the Late Holocene

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# Foreword

The transition from foragers to farmers and the role of intensive rice agriculture have been among the most controversial subjects in Korean archaeology. However, the relatively high acidity of sediment in the Korean peninsula has made it impossible to examine faunal/floral remains directly for tracing the subsistence change. For this reason, many of the studies on the transition heavily relied on the shell middens in the coastal areas, which reflect only a small portion of the overall subsistence in the Korean Peninsula. The subsistence behaviors recorded in numerous large-scale inland habitation sites have been obscured by the overall separation between hunter-gatherer and intensive rice farmer. My dissertation research investigates the role of intensive rice farming as a subsistence strategy in the central part of the prehistoric Korean peninsula using organic geochemical analysis and luminescence dating on potsherds. The central hypothesis of this research is that there was a wide range of resource utilization along with rice farming around 3,400-2,600 BP. This hypothesis contrasts with prevailing rice-based models, where climatically driven intensive rice agriculture from 3,400 BP is thought to be the dominant subsistence strategy that drove social complexity. This research focuses on four large-scale inland habitation sites that contain abundant pottery collections to evaluate the central hypothesis as well the prevailing rice-centered model. This research produced critical data for addressing prehistoric subsistence of Korean peninsula and established detailed chronology of subsistence during 3,400-1,800 BP.

This monograph was supported by the Laboratory Program for Korean Studies through the Korean Studies Promotion Service/Academy of Korean Studies, Ministry of Education of Korea (AKS-2015-Lab-2250001). During my postdoctoral employment at the University of Oregon with the Laboratory Program, I was able to further elaborate my doctoral dissertation, entitled the “Long-term chronology of subsistence and the role of intensive agriculture in the central part of the Korean peninsula during the Late Holocene” for this book. The dissertation was a product that benefited by considerable advice and support from so many people. My academic advisor, Dr. Ben Marwick, provided me one of the rarest chance to study archaeology as a science. His passion, encouragement, and guidance had a vital role in the development of the thesis. My other committee members, Dr. Peter Lape and Dr. James Feathers gave me invaluable comments that made the final product incomparable to the first draft. The Graduate School Representative (GSR), Dr. Rick Keil, was as helpful as other committee members with his profound knowledge in organic chemistry. Considering the international and interdisciplinary character of the project, many collaborators and institutions from United States, United Kingdom, and South Korea assisted in the completion of the thesis. Dr. Julian Sachs, Dr. Joshua Gregersen, Dr. Daniel Nelson taught me how to prepare and analyze lipid samples. I was also truly benefited by the sincere help from Dr. Richard Evershed, Dr. Julie Dunne, and Dr. Marisol Correa-Ascencio at the Organic Geochemistry Unit, University of Bristol. I would not have gotten this far without their advice. Dr. Byeong-mo Kim (Korea Institute of Cultural Heritage), Dr. Gyeong-taek Kim (Korea National University of Cultural Heritage), Dr. Tae-seop Choi (Yonsei University), and Dr. Soojin Kong (Sejong University) kindly provided their Korean potsherd samples for this research. I would like to say special thanks to Ah-guan Kim (Korea Institute of Cultural Heritage) and Taehong Kang (Korea Institute of Cultural Heritage) for helping me collecting suitable samples. Also, thanks to Dr. Gyoung-Ah Lee (University of Oregon) and Dr. Chuntaek Seong (Kyung Hee University) for their sincere advice.

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# 1. Subsistence change, Emergence of agriculture, and Rice

## 1.1. The role of the intensive rice agriculture in the central part of the Korean Peninsula

According to the recent report from the Food and Agriculture Organization of the United Nations (FAO), the average annual rice consumption per person in Brunei and Vietnam is 245 Kg and 166 Kg (Faostat 2011). These two countries mark the 1st and 2nd in rice consumption in the world. The average annual rice consumption per person in South Korea in 2011 was 88 kg (the Korea National Statistical Office). However, according to historical records, the annual South Korean rice consumption per person around the 18th century was about 173 kg. Though the westernized life style of South Korea reduced its annual rice consumption rate, rice is still the mainstay of its modern diet, and has been so for at least 2,000 years. The Korean people's attachment to rice is remarkable. The word for 'meal' in Korean is 'bab', which also and originally means 'steamed rice'. Regardless of their economic status, way of life, or ideological inclination, steamed rice was and is the essential dish throughout the nation. For the Koreans, 'A bowl of rice is equivalent to love and affection' (Woo, 2012). In this regard, one of the main topics of Korean archaeology over the last 50 years has been investigating the process of the subsistence change from hunter-gatherers to intensive rice farmers. However, despite continuous attempts to reveal the overall pattern of the change and accumulations of data, we still lack information on some of the most basic parameters involved in the role of the intensive rice agriculture in the prehistoric Korean Peninsula.

The central part of the Korean Peninsula (Figure 1.1) contains a vast amount of archaeological data related to the subsistence change in the deeper past. This region has provided rich archaeological records documenting its general culture history. Its earliest known occupants were Paleolithic foragers dated to about 200,000 years ago (J. C. Kim et al., 2010). Clear evidence show that full-dress farming was practiced in this region around 3,400 BP (G. A. Lee, 2003, 2011). Solid evidence of dry fields, irrigated rice paddies and harvesting tools have been found (Yoon & Bae, 2010). However, due to the lack of paleobotanical evidence from this period, detailed information about when rice became the mainstay of the Korean diet is not yet known. Therefore, the study of the transition from hunter-gatherers to farmers, and the role of the intensive rice agriculture in this transition, is integral to anthropological debates.

The transition from foragers to farmers in the Korean Peninsula has been described as the subsistence change from hunter gathering to intensive rice farming around 3,400 BP (J. H. Ahn, 2000; B. C. Kim, 2006a, 2006b; J. S. Kim, 2003; Norton, 2000, 2007). B. Kim (2006a) argued that an agricultural economy based heavily on rice spread suddenly and swiftly into the foraging context with few evidences of a transitional period (cf. G. A. Lee, 2011). However, recent paleobotanical data on the southern part of the Korean Peninsula have revealed that people in this period were more dynamic and varied than is posited by the models focused on the intensive rice farming (Crawford and Lee 2003; G. Lee 2003, 2011). For example, along with rice, they utilized other crops such as millet, soybean, and azuki for their subsistence. These new data require an alternative model which could explain the role of the intensive rice agriculture in this period.

This monograph investigates the role of intensive rice agriculture as a subsistence strategy in the central part of the Korean Peninsula, contributing new data that helps to establish the chronology of subsistence over the last 3,400 years. This research will provide an insight into when rice became the mainstay of the Korean diet. Low hills with gentle slopes embracing meandering rivers in this region were continuously occupied for as much as 4,000 years, and large inland habitation sites developed in this condition provide the multiple lines of subsistence data that are required for this study. The central hypothesis in this research is that a wide range of resources were utilized along with rice between 3,400 and 2,000 BP. This hypothesis contrasts with the prevailing rice-centered models, which assume rice to be the most dominant subsistence resource since 3,400 BP.

The primary goal of this research is re-evaluating the conventional rice-centered models to better understand the overall pattern of subsistence strategy and assess the weight of rice in it. To achieve this goal the study (1) tests the hypothesis that a wide range of resources were utilized along with rice between 3,400 and 2,000 BP., and (2) establishes a general chronology of subsistence during this period, incorporating in that work the organic geochemical analysis and luminescence dating of the pottery excavated from four large inland habitation sites in the central part of the Korean Peninsula.

In Korean archaeology, pottery is one of the primary analytical resources, being abundant in almost every archaeological assemblage in the Korean Peninsula since 6,000 BP. However, despite intensive relative chronology-building, almost no attention has been given to analyzing the fabric of the pottery itself. Studies have showed that high-temperature boiling using pottery is particularly effective in the preparation of various resources (Stahl 1989; Wandsnider 1997). This represents a serious gap in our understanding of the prehistoric subsistence in Korea during the critical time of the transition from foragers to farmers. The methods proposed here allow me to test the prevailing rice-centered models, first by identifying what was stored and cooked in the pots, and second by dating the pots directly and absolutely. By doing so, the study establishes a general and robust chronology of subsistence between during 3,400 and 2,000 BP. The results of my research provide critical information about the role of the intensive rice agriculture in the prehistoric Korean diet.

In this study a total of 138 potsherds were collected for the organic geochemical analysis and seven sherds were dated with the luminescence dating. Based on the results of the organic geochemical analyses, each potsherd was assigned to a different food class. Then, these potsherds were ordered in time, based on the results of the luminescence dating and available AMS radiocarbon dating. By doing so, I was able to achieve the primary goal of this research: a re-evaluation of the conventional rice-centered models to better understand the overall pattern of subsistence strategy and assess the weight of rice in it.

### 1.2. The transition from foraging to farming and the emergence of agriculture

The process of the transition from foraging to farming and the emergence of agriculture are long standing topics of archaeological investigation (Binford, 1968; Childe, 1951; Flannery, 1972, 1976; Redman, 1978). The emergence of agriculture and its role in subsistence is one of the most studied domains in archaeology. The intensification of agriculture and the control over agricultural surpluses have been linked to the origins of the socio-political complexity (Childe, 1951; Earle, 2002; Price, 1995; B. D. Smith, 1989; Welch & Scarry, 1995). A recent collection of papers in Current Anthropology (Vol. 52, 2011) indicates the importance of this topic and diversity of approaches to the transition from foragers to farmers. Current approaches to understanding the subsistence change from foragers to farmers would fall into four categories: (1) population pressure model, (2) climatic fluctuation model, (3) cultural or social model, and (4) evolutionary model.

One of the most well-known approaches is the population pressure model (Binford, 1968; M. N. Cohen, 1977, 2009; Flannery, 1972, 1976). This approach starts with the idea that farming is backbreaking, time consuming, and intensive-labor work. Based on the ethnographic analysis of the Kalahari Desert of South Africa, Binford suggested that even in a marginal area, food collecting was a successful adaptation (1968). Therefore, he argued that human groups would not have become farmers, unless they had had no other choice. Population pressure was therefore suggested as a proper agent for the origin of agriculture: more people required more food. The best solution to the problem, according to Binford, was farming, which provided a higher yield of food per a unit of land. However, at the same time, the intensification of agriculture required more labor to harvest food. M. Cohen (1977, 2009) argued for an intrinsic tendency of growth of human population, which is responsible for the initial spread of the human species out of Africa, and the subsequent colonization of Asia, Europe, and the Americas. Along with this population

growth, after about 10,000 BC there was an increase in the use of less desirable resources in many areas. Cohen argued that the only successful way to cope with increasing population and declining resources was agriculture.

The second approach emphasizes climate fluctuation. The role of the rapid climate change in the process of subsistence change is certainly a factor to be considered at various specific points in time (Belfer-Cohen & Goring-Morris, 2011). Bar-Yosef (2011) argued for the rapid climatic fluctuation as the main factor in the origin of the cultivation of various wild plants in East and West Asia. The model is based on the idea that the origin of cultivation was motivated by the vagaries of the climatic fluctuation of the Younger Dryas around 10,000 B.C. within the context of the mosaic ecology which affected the communities that were already sedentary or semi-sedentary. By examining paleoclimatic records with available archaeological phenomena, Bar-Yosef proposed that while the rapid climatic fluctuation served as a trigger of the beginning of cultivation at the end of the Younger Dryas, such changes continued to influence the Holocene period of both East and West Asia.

The third category of approaches focuses more on cultural or social aspects. Cauvin (1994) argued that the important changes associated with the subsistence change from foraging to farming were conceptual as much as, or more than just material (i.e. food production). Specifically, he suggested that farming was led by the emergence of new conceptual ideas such as new cosmology, religious practice, and symbolic behavior. For Cauvin, this transition allowed foragers to view their habitat in a different way and promoted a more active exploitation of their environment. Based on the archaeological phenomena of four cultural areas in China, D. Cohen (2011) argued that the Early Neolithic culture in China, which involved the farming of millet and rice, was invented and spread with a wide range of information exchange and broad social networks rooted in the interactions of Late Paleolithic hunter-gatherer societies (D. J. Cohen, 2003). Recent studies showed that the agricultural origins took place in relatively abundant environment, not in places where little food was available (Price & Gebauer, 1995). This partially supports the idea that the subsistence change from foraging to farming might not be solely explained by the economic aspect.

The last category of approaches is based on evolutionary perspectives. The most well-known study is done by Rindos (1984). He focused on the coevolutionary mechanisms between plants and people during the domestication, incorporating three stages of process: Incidental domestication, specialized domestication, and agricultural domestication. Rindos's explanation for the origin of agriculture can be defined as a neo-Darwinian evolutionary approach. A human is an unconscious agent who selects only for instant benefits. Most models proposed for the origin of agriculture relied on problem-solving abilities of the human to explain this transition: peoples' intent or desire for more sustainable food. But for Rindos, people could not intentionally domesticate plants. However, they did favor those plants that were most useful to them. Man can select, but he could not have known how important the products of their selection would become. Rindos did not address why the agricultural system developed after the end of Pleistocene. He described the question why humans began to establish their coevolutionary relationships with plants as a question without meaning. To Rindos, the explanation for the origins of agriculture will be ecologically specific to each world area where this process took place (Rindos, 1984).

More recent approaches in evolutionary models are based on the evolutionary ecology (Gremillion & Piperno, 2009; Winterhalder & Kennett, 2006, 2009). The evolutionary ecology emerged from an earlier perspective known as 'cultural ecology', which focused on the dynamic relationship between the human society and its environment (Steward, 1972). Evolutionary ecologists have emphasized human ability to reason and optimize their behavior. In this view, the cultural and behavioral change is explained as a form of phenotypic adaptation to changing social and ecological conditions, applying the assumption that organisms are designed by natural selection to respond to their environment in 'fitness-enhancing ways' (Boone & Smith, 1998: 141; Cannon & Broughton, 2010); Winterhalder & Smith, 1992). Archaeologists often assume that hunter-gatherers operate based on the premise of efficiency to obtain sufficient food.

Food is ranked by the energy value it contains; and lower-ranked resources such as seeds are demanded, only as higher-ranked ones become unavailable. In this view, the subsistence change to farming is explained as adding new resources.

Current evolutionary approaches to the subsistence change from foragers to farmers have expanded to sub-disciplines such as the niche construction Theory (Bleed & Matsui, 2010; Crawford, 2011; B. D. Smith, 2007). The niche construction theory emphasizes long-term reciprocal dynamics between humans and their environment, in which modification of their environment helps create the niche they inhabit (Laland & Brown, 2006; Laland, et al., 2001; Odling-Smee et al., 2003). Niche construction by a large number of animal species has been studied in various different regions around the world. Given that so many different animal species manipulate their environments, it is reasonable to assume that humans have been actively managing their environment to varying degrees (B. D. Smith, 2007). Ethnographic studies have documented a growing inventory of the different ways in which human societies actively intervene in their local environments in an effort to shape them more to their liking (B. D. Smith, 2007: 195). In this perspective, agriculture can be one of the acmes of human niche construction.

The rest of the chapters in this monograph will lead us to show which of those models/theories is suitable for explaining the transition from foraging to farming in the central part of the Korean Peninsula by incorporating the innovative analytical methods: the organic geochemical analysis and Luminescence dating.

### 1.3. What do we know so far about transitions to agriculture?

Some of the studies that I have mentioned above show that in some parts of the world, farming spread rapidly and patchily from one place to another. However, other studies indicate that it spread very slowly in other areas; in some places people did not become farmers for up to a millennium after their initial contact with agriculture, or never became farmers at all. Sometimes these areas are environmentally segregated (e.g. Alps or Pyrenees), but can be also defined by social factors (Robb, 2013). If we think of places that show any evidence of farming (for example, Europe, which is the most thoroughly studied region in relation to the emergence of agriculture and spread of farming), there are several underlying characteristics these areas have in common, which will be discussed from now on (Robb, 2013; Whittle & Cummings, 2007).

#### *1.3.1. Migrations of farmers*

Though it is highly varied in form, it is true that there were actual movements of farmer/farmers from one place to another. However, at the same time, there is no real evidence for a massive migration in terms of a single big wave of movement which covered large landscape. In fact, most archaeologically traceable human movements are ‘opportunistic leap-frog’ (Boland, 1990; Robb, 2013: 658) migrations. These movements seem to involve small groups of people with no typical single origin, resulting in a complicated form of migration without homeland.

#### *1.3.2. Genetic studies*

Unfortunately, unlike the initial optimistic views (Cavalli-Sforza et al., 1994), the results of genetic studies are quite ambiguous and inconclusive. Though several researches showed that there is genetic discontinuity between hunter-gatherers and early farmers, and between hunter-gatherers and the modern population in some places (Malmström et al., 2009; Rowley-Conwy, 2009), other studies suggest that both incoming and indigenous peoples contributed to the gene pool of the modern population(Bramanti et al., 2009; M. Richards, 2003).

### *1.3.3. First contact*

In many cases, when there is contact between foragers and farmers, the former often adopt new subsistence strategies (such as farming) little by little for their own sociopolitical purposes (Robb, 2013). This is somewhat different from the traditional view that new economic practices (based on farming and animal domestication) with innovative technologies (notably, pottery and new types/forms of stone tools) rapidly spread into the foraging context as a 'package', completely transforming the society to a fully farming community (Childe, 1951).

Summing up, if there is any conclusion that archaeologists can reach, it would be that the transition from foragers to farmers and spread of farming occurred in a 'mosaic way' (Robb, 2013: 659). This means the transitions occurred around the world in various and diverse ways. This diversity motivates us to investigate the specific manifestations of this transition in different parts of the world and better understand the different ways that people made this profound transformation.

## 1.4. Cases in East Asia

Since the main study area of my research is the central part of the Korean Peninsula, it is worth to examine the transition from foraging to farming and the emergence of agriculture in its neighbors, namely China and Japan, to provide some regional context. Numerous archaeological and historical studies showed the similarities between the material cultures from those three regions (Nishitani, 2014; Noh, 2003; Y. S. Seo, 1981). Geographically, China is located in the west of the Korean Peninsula and its northeastern boundary is bordering the north of North Korea (Figure 1.1). The Japanese archipelago extends from northeast to southwest along the east side of the Korean Peninsula (Figure 1.1).

### *1.4.1. China*

The critical time period related to the transition from foraging to farming and the emergence of agriculture in China is that between 12,500 and 9,000 cal BP when hunter-gatherers in four distinct geographical
10 regions (Northeast China, the North China plains, and the Middle and Lower Yangtze River regions) established the first sedentary villages (D. J. Cohen, 2011). Recent debates have been focusing on the timing and the speed of this transition (Crawford, 2009; Fuller et al., 2009, 2010; Liu et al., 2007; Zhao, 2011), investigating how harvested crops (e.g. rice and millet) were incorporated into changing the mode of subsistence over a 3,000-year period (D. J. Cohen, 2011: 29). Unfortunately, it is still not clear where agriculture first started. The lower Yangtze region, where rice agriculture begins, was assumed to have the earliest evidence of plant domestication. However, new data showed that the northern plains of China have the independent tradition of early millet farming (Bar-Yosef, 2011; Barton et al., 2009; Bettinger et al., 2007; Lu, 2006; Shelach, 2000). Although the fundamental reliance on the harvested crops such as rice and millet was once thought to be a major part of the change, in recent years it has become clear that this is not the case. The advent of plant domestication and the subsequent agriculture was a slow process in a number of small steps, region to region (D. J. Cohen, 2011; cf. Robb, 2013).

### *1.4.2. Japanese Archipelago*

Traditionally, in Japan, the strict dichotomy between Jomon Neolithic hunter-gatherers and Yayoi Bronze Age farmers persisted among the archaeologists. This trend began in the 1980s when the concept of affluent foragers was considered to provide a suitable explanation of Jomon economy (Aikens et al., 1986; Koyama et al., 1981). However, this widely accepted view that the Jomon people sustained their hunter-gathering life for several thousands of years in a "naturally rich environment (Crawford, 2011: S336)" was criticized by other scholars, for it oversimplifies the Jomon subsistence (Crawford, 2008; Kobayashi et al., 2004; M. Nishida, 1983). A recent study from Obata and his colleague (2007) showed solid evidence of plant domestication during the Middle Jomon period in the Kyushu area.

To most Japanese archaeologists, farming is considered as irrigated rice agriculture during the Yayoi period. However, according to Crawford (2011) the Yayoi agricultural system was not solely based on rice. A wide range of plants including millet, barley, wheat, and leguminous was also a significant component of the Yayoi agricultural economy.

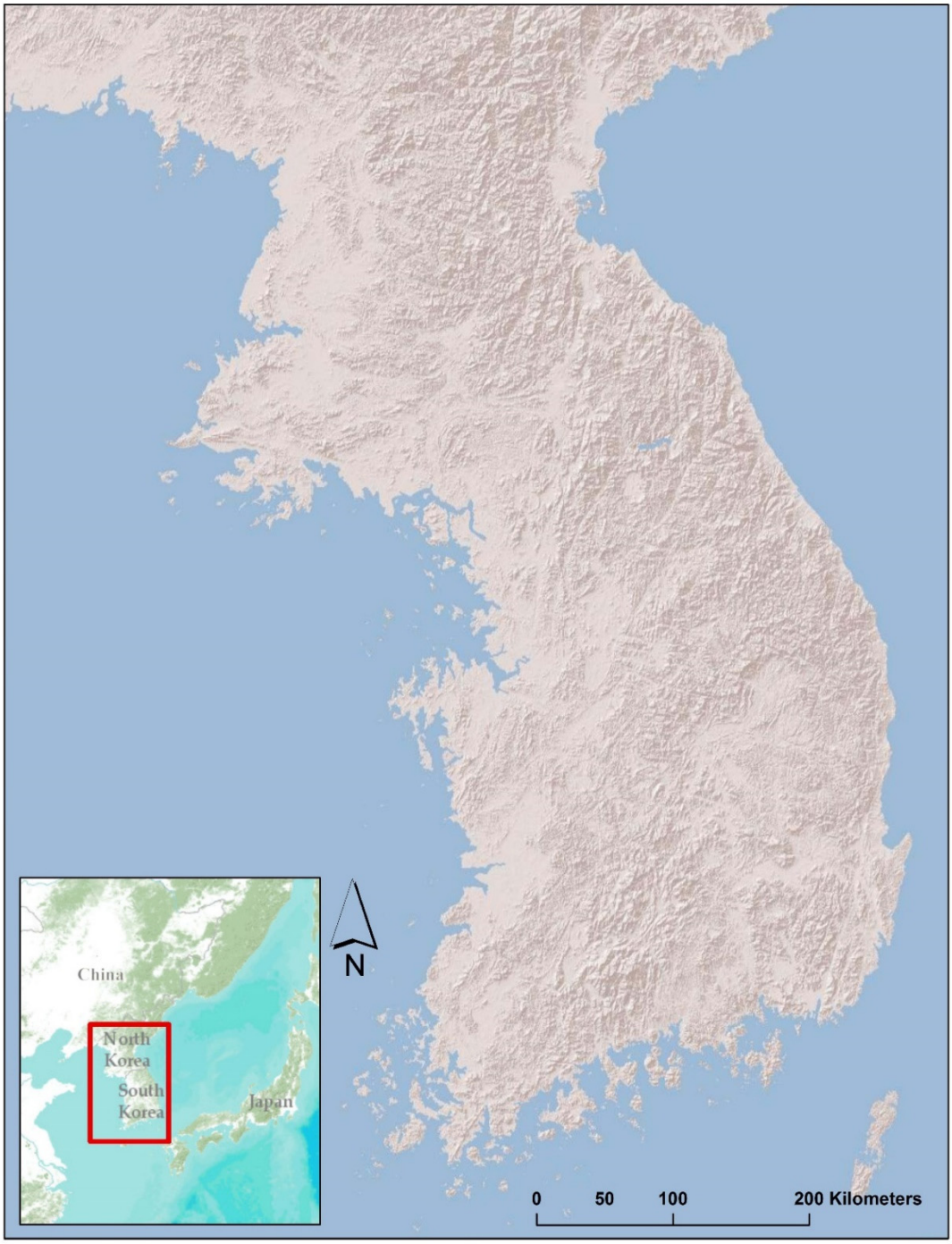


Figure 1.1: The map of the Korean Peninsula and its vicinity