Postglacial Hunter-Gatherer Adaptations in the Korean Peninsula

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Introduction

In Korean archaeology, postglacial cultural change is undoubtedly one of the most difficult issues to address. The challenge lies in the paucity of adequate archaeological data, and the resultant lack of literature dealing with this critical period. Korean scholars of previous generations hypothesized that Paleolithic hunter-gatherers moved off the peninsula to the north, while subsequent Paleo-Asiatic people moved down to the unoccupied Korean Peninsula (Kim Jeongbae 1973; Kim Wonyong 1986). However, this assumption has been subjected to reasonable criticism for being too simple and for lacking supporting evidence (An Seungmo 2003; Yi Seonbok 1991).

Many continue to hope that reliable archaeological data will eventually emerge to fill the gap. Despite the unprecedentedly rapid increase in the number of excavated sites during the last two decades, however, we still do not have any relevant archaeological sites to help us address the postglacial human adaptation in the southern peninsula. Rather than avoiding the archaeological discussion of this integral period, I try to explain the phenomena in terms of the dynamics of hunter-gatherer subsistence and mobility. The likely response of hunter-gatherer groups to the changing environment provides an alternative explanation for the paucity of archaeological evidence from the postglacial period.

Postglacial Environmental Change

The climate change associated with the last glacial period is recognized globally, and the abrupt temperature drop known as Younger Dryas (YD) (c. 12,800-11,500 calibrated years BP) has been detected not only in the northern latitudes, but also in southern China, the Yellow Sea, and East China Sea. The YD stadial was followed by a sudden rise in temperature, marking the onset of the Holocene and postglacial period. The subsequent 3000 years of global warming was so rapid that it drastically altered the structure of global vegetation systems and caused major faunal extinctions in many parts of the world.

In Korea, the most characteristic feature of postglacial environmental change is the emergence of the peninsula itself. As Fig. 1 shows, the rising sea level swiftly submerged the once exposed Yellow Sea Basin. During the Last Glacial Maximum (LGM), Korea and Japan were still divided by the narrow Korean strait (12-15 km wide and 10-30 m deep) (Lee Eunil *et al*. 2008). Still, during the LGM, the geographical affinity between the two regions provided opportunities for considerable cultural contact, as exemplified by tanged points and backed knives, which are typical artifacts of the early Japanese Neolithic (Jang Yongjun 2007). The exotic objects from Japan still appear in southern coastal sites in Korea during the early Neolithic period, but subsequently, the increasing distance between the two regions likely became an obstacle greatly hindering routine contact. In other words, postglacial environmental change in Korea, marked by the emergence (around 12,000 BP) of the Yellow Sea in the west and the widening of the once extremely narrow straits dividing the peninsula from the Japanese Archipelago in the east, due to the rapid rises in sea level, must have been a significant challenge to local foraging groups trying to adapt to the new environment while maintaining regional social networks.

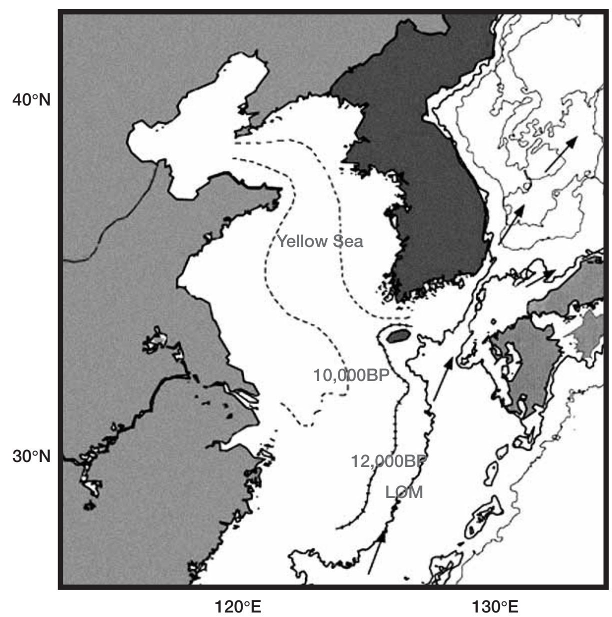

Fig 1. Sea-level change and emergence of the Yellow Sea during postglacial period (Redrawn based on Lee Eunil *et al*. 2008, Fig. 1; Shin Sukjeong 1998, 238). The LGM line indicates the inferred coastline during the maximum extent of continental glaciers (Last Glacial Maximum), also representing the narrow strait between Korea and Japan. The 12,000 BP and 10,000 BP lines illustrate the rapid change in sea level that eventually created the modern day geography of Korea.

Critical Review of Current Perspectives

Again, the primary archaeological problem obstructing analysis of this setting is an utter lack of hard evidence to demonstrate aspects of adaptation to the changing environment. The traditional archaeological explanation assumes cultural discontinuity and the immigration of new people from Siberia, a typical historical explanation of culture change focusing on diffusion and migration. In an influential monograph of Korean archaeology, Kim Wonyong (1986:22) wrote:

> ... rather than staying where they were and developing the Mesolithic culture, the Paleolithic people moved to the north in pursuit of large animals. Thus, the modern day Korean Peninsula was uninhabited territory for 2000-3000 years during the early postglacial period...

The new people who moved down to inhabit the unoccupied peninsula then established the Neolithic culture (Kim Jeonbae 1973; Kim Wonyong 1986). However, this account conflicts with the current archaeological data, such as the fact that the emergence of pottery in Siberia actually postdates early pottery remains from the Amur region (An Seungmo 2003).

In the 1970s and 1980s, another possibility was suggested: the Mesolithic concept. Choe Bokgyu (1974) and others, including some North Korean archaeologists (Kim Yonggan 1991), postulated that microliths were the index artifacts for the Mesolithic. However, tephrochronology(dating by means of the study of layers of volcanic ash) and other relative dates now suggest that the microlithic tradition goes back to the late MIS 3 (Seong Chuntaek 2008 and 2011). In fact, the Mesolithic concept has lost its relevance in East Asian contexts, given that the early emergence of pottery in the Amur and Japan goes back to the late Pleistocene, based on radiocarbon dates as old as 13,000 B.P. from Ustinovka 3 and Novopetrovka.

While some still advocate the cessation of human occupation during the period, many have begun to turn their attention to adjacent areas in search of relevant evidence for postglacial cultural change. As scholars assume that similar cultural features were widespread throughout much of Northeast Asia, Gosan-ri and Sangnodaedo are considered two possible candidates for human occupation during the postglacial period in Korea (Lee Heonjong 2002). Lee Dongju (1998: 67) even proposes possible migration routes from the Amur to the Japanese Jomon via the two sites, but his hypothesis is as simple and unsubstantiated as the 1970s hypothesis of Paleo-Asiatic migration. Both Gosan-ri and Sangnodaedo are located in southern islands of Korea, not on the peninsula per se. As a matter of fact, we still do not have unequivocal archaeological evidence of postglacial human occupation in the southern peninsula.

Some attribute the paucity of data to geological processes that induce heavy erosion (Yi Seonbok 1992: 23). While the possibility of occupations currently submerged in the Yellow Sea cannot be denied, I do not agree with the opinion that most inland occupations were eroded away. In fact, a significant number of postglacial geological deposits exist throughout the peninsula; thus, the problem is not the lack of deposits themselves, but rather the lack of evidence suggesting human occupation.

Despite the incredible increase of archaeological expeditions during the last two decades, we certainly do not have sufficient archaeological evidence for postglacial human occupations in Korea. We have numerous Late (Upper) Paleolithic sites throughout the peninsula, as exemplified by the dense distribution of more than 50 archaeological locations, mostly Late Paleolithic, in the county of Imsil (Lee *et al.* 2007). In other words, decades of archaeological research have failed to uncover considerable postglacial archaeological evidence.

Yet many still seem to anticipate that we will eventually find relevant archaeological records for the period, and indeed, we cannot negate the possibility that future research will reveal unknown cave or rock-shelter sites. Unfortunately, the example of Europe teaches us that few cave occupations appear once estuarine adaptations become widespread. I believe that it is time to consider "absence of evidence" to be "evidence of absence," given the great increase in the amount of archaeological field research over the last two decades and the concurrent lack of data. Therefore, I herein present my own hypothesis, which proposes the significant drop in human occupations in the Korean Peninsula during the postglacial age, based on a critical review of hunter-gatherer mobility, social networks, and population structure.

Hunter-Gatherer Mobility and Demographic Structure

Most hunter-gatherer societies are mobile, with the exception of several coastal groups that rely on aquatic resources. Many human behavioral ecologists posit that such mobile lifestyle is the outcome of a long evolutionary process towards securing food and other resources (Kelly 1995).

As shown in Table 1, mobile foraging bands routinely consist of several families, comprising 25-50 individuals, and they maintain a low population density of 10 to 20 per 100 km^2. They vary considerably in how often they move their residential bases, from two to 50 times per year. For example, the Hadza in East Africa move their camp 27 times/year, at an average of 8 km distance and area of 2,520 km^2(Kelly 1995). The total year-round area of subsistence and mobility of a local band varies in the mean distance of move from 5.9 to 70 km, and in area from 260 km^2 for the Ju/'hoansi to 20,000 km^2 for the Nunamiut. The foraging area largely depends on the type of resources that a group relies on, with arctic hunt-

Table 1. Summary of mobility, group size, and population density for some well known hunter-gatherer groups

Group	Geographic location	Band size	Residential move per year	Average move distance (km)	Total area (km^2)	Population density (100 km^2)
Netsilingmiut	North American Arctic		14	16.8	6,000	0.5
Baffinland Inuit	Arctic	35(mean) (Iglulingmiut)	60	12	25,000	0.5
Nunamiut	Alaska		10	69.5	5,200-20,500	2
Cree	Northern Hudson Bay	25-50			2,890-3,385	0.4 (Waswanipi)
Crow	North America		38	19.2	61,880	2.6
Aché(Guyaki)	Paraguay	16	50	5.9	780	3
Ainu	Japan		2	4.3	171	
Ngadadjara	Australian desert	20	37	43	2,600	
Hadza	East Africa	20-60	27	8	2,520	15
Semang	Malay Peninsula	20-30	26	11.3	2,475	5-19
Batak	Philippines		17-26			54
Alywara	Australia				1,500	2.5
Birhor	India	27(mean)	8	10.3	130	22
Ju/'hoansi	Southern Africa	25(average)			260-2,500	10-16

This table was prepared by summarizing the data from Kelly 1995, Table 4-1 (pp. 112-115), 6-2 (p. 211), 6-4 (pp. 222-226).

ers normally taking larger subsistence territories than temperate zone foragers.

According to the central place foraging model, individuals and small work groups radiate from and return to a central place. Daily foraging distances vary, but foragers usually make one- to two-hour trips (5 to 10 km) to exploit nearby food resources. While the productivity decreases as the length of time foragers spend in a patch increases, the marginal value theorem predicts that foragers move their camp to another resource patch before they have completely depleted the current patch (Kelly 1995). Factors affecting the frequency and pattern of mobility include productivity of target resource patches, distance, topography, and (significantly) the relationship with neighboring bands. However, the most important constraint is the existence and availability of animal resources, as settlement patterns rely closely on the type and availability of high return resources, as predicted by the diet breadth model.

One of the most influential works regarding hunter-gatherer group size and social networks was the population model proposed by Martin Wobst in 1974. According to Wobst's simulation, a local foraging band made up of 5-7 families and 25-30 persons is the minimal social unit that "can withstand short-term fluctuations in fertility, mortality, and sex ratio for any length of time" (Kelly 1995, 211). In other words, having around 25 members provides enough size for the group to stay demographically viable while still remaining small enough to avoid rapidly depleting local resources.

Mobile local bands, however, could not sustain their long term survival without social ties involving friendships and partnerships with other neighboring groups, as the social network provides a safety net securing long term survival. Cooperative groups stay in regular contact with each other, exchange resources and information, and importantly, form marriage partnerships. From a spatial perspective, such social ties can be modeled in a series of hexagonal structures, where a local band regularly contacts with six comparable neighboring groups (Fig. 2). Hence, the seven groups, consisting of 175 to 200 people, form a larger group connected by regular and direct contact. Ethnographic works on band-level societies also reveal 5.4 to 5.97 adjacent groups in regular contact, which is consistent with the spatial model (Birdsell 1953).

Studies go further in suggesting two tiers of the hexagonal model, wherein 19 mobile bands of 475 to 500 people form breeding networks or a "marriage universe" (Whallon 1206; Wobst 1974). Notably, the number of 500 people originally comes from the ethnographic and gene flow model for Australian Aboriginal data (Birdsell 1953). The figure essentially indicates the minimum size of a breeding population unit, since no mobile local bands can be self-sufficient. The allied network also provides culturally related band groups, as well as archaeologically applicable models for late Pleistocene and early Holocene hunter-gatherers. The successful global dispersal of anatomically and culturally modern humans can be directly attributed to such social ties, demographic structure, and division of labor, which have been almost universally observed in historic foraging groups (Gamble 1999; Wobst 1974).

Putting aside complex issues, hunter-gatherers normally maintain flexible territoriality and social boundaries, which in turn suggests that territoriality and boundaries are best understood in terms of connections to other groups. In other words, such factors are social, rather than geographical. In this way, the residential and logistical mobility of a local band is planned and practiced in a relationship with other neighboring groups.

Archaeological Implications

Focusing on the social dimensions of hunter-gatherer mobility, Whallon (2006) convincingly demonstrates the spatial structure of final Pleistocene and early Holocene occupations in Germany. A mobile band made up of 25 to 30 persons is estimated to move in a radius of 28 km, based on the reconstruction of Magdalenian exploitation areas, covering a total of about 2,500 km^2. The regional bands each measure a radius of 125 km, encompassing 47,500 km^2, and a population of 475-500 people, being made up of 19 local or minimal bands each of 25-30 people. The maximal band, comprising 7 adjacent regional bands, measures a radius of 325 km, and encompasses about 332,500 km^2, with a population of 3,325-3,500 people (Fig. 2). The regional and maximal bands represent the social allies who regularly exchange information, materials (e.g. lithic raw materials), and individuals through marriage.

Furthermore, "exotic" materials are sometimes transported from as far as 200-300 km, providing the need to consider larger "indirect" contact zones. At this level, the social contact is mostly confined to "non-utilitarian" symbolic items, such as shells and exotic lithic raw materials, as discussed by Whallon (2006). According to Gamble (1999), in Upper Paleolithic Europe, the average distance that lithic raw materials were transported was 51.6 km in the southwest, 82.2 km in the northwest, and 157.3 km in the northern central.

This estimation in turn provides a valid starting point for considering the regional hunter-gatherer societies of the southern Korean Peninsula, which measures some 100,000 km², not a large territory for highly mobile foraging bands. According to Whallon's (2006) model, we can hypothesize that the area was inhabited by some 40 local bands and six regional bands of interbreeding groups, thus constituting just two or three maximal regional bands with a marriage universe of some 500 people.

Provided that this is a tentative estimate based on ethnographic data and archaeological research on North Central Europe, we may assume more local bands and regional groups. Even so, if the area of 1,000 km² were occupied by some 100 local bands, the population would still be less than 5000. Again, if we consider a population density of 5-10 people per 100 km² for the bottom line, the population could not exceed 10,000. In any case, we can estimate that the southern Korean Peninsula was occupied by a small number of mobile foraging bands who maintained close social ties with other groups. Based on this reasonable scenario, the system would have been quite vulnerable to environmental change, i.e., vegetational and faunal restructuring.

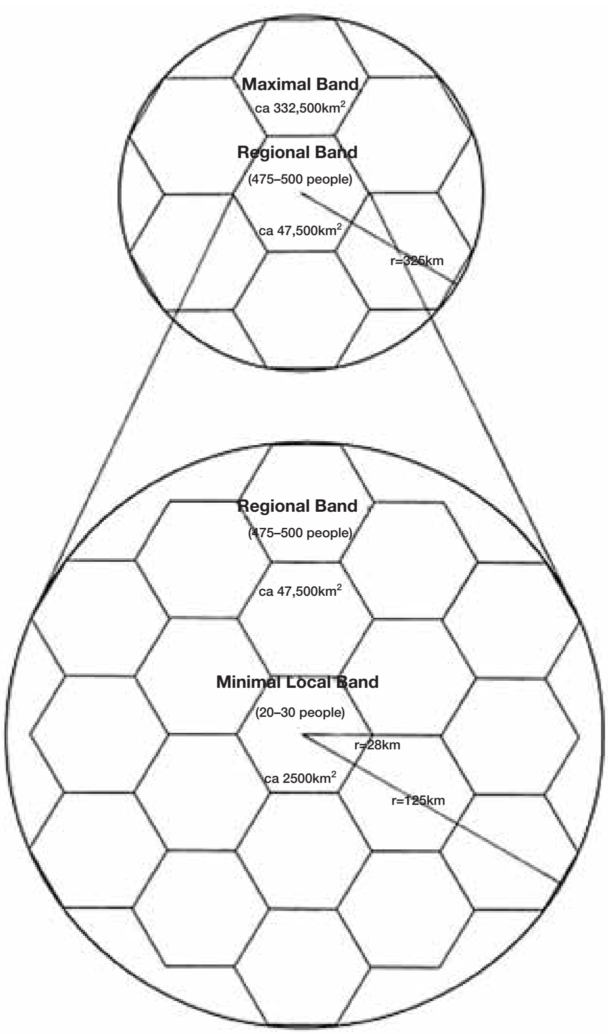

Fig 2. A schematized model of hunter-gatherer spatial structure proposed by Whallon (2006: 267, Fig. 4), with modification

Postglacial Hunter-Gatherers at the Crossroads

Any successful discussion of changing adaptive strategies of postglacial hunter-gatherers must consider their demographic structure. Populations of small societies are more prone to changes caused by both internal and external circumstances, such that unpredictable fluctuations could drop the population well below the carrying capacity. While many mechanisms were known to control population growth, the population largely depends on interactions between reproduction, foraging behavior, and resource abundance. Given the spatial structure in terms of demography, small fluctuations of resource density can likely be absorbed by a regional social network. In this way, the population structure is not only an aspect of local bands, but is closely related to the regional exchange network. While short term fluctuations in resources can likely be offset by spatial allies or other safety nets, if neighboring local bands suffer similar subsistence failure, due to perennial unpredictability and prolonged resource perturbation, the problem can rapidly disperse through the regional network, resulting in significant population decrease at the regional level.

I believe that this was essentially what happened with postglacial hunter-gatherers in the Korean

Peninsula. Although the creation of the peninsula geography would not have resulted in environmental deterioration at the level of glaciation, such transformation likely threatened the regional network that had existed for several thousand years. Given that foragers move their residential base before the resources are depleted, as predicted by the marginal value theorem, the rising sea levels and subsequent loss of habitat in the Yellow Sea Basin likely forced local mobile groups to increase both the distance and frequency of their mobility, while some groups would have merged with northern and eastern allies. Given the close regional networks and high mobility during the final Pleistocene, as evidenced by numerous microlithic assemblages throughout the peninsula (Yi Heonjong 2002; Yi Gigil *et al.* 2007; Seong Chuntaek 2008, 2011), such movements probably affected the entire system of adjacent regional bands.

According to the diet breadth model and other studies of foraging behavior, the most likely response to changes in the environment and in the type and density of resources is to expand the diet breadth or to specialize in high-return resources. The postglacial decline of available animal resources, especially high-return large game and migrating herbivores, put pressure on mobile foraging bands to increase the distance and frequency of mobility. Significantly, such movements likely affected other local bands in the regional network. Given the constant flow of information among neighboring groups, and the fact that the territory of the maximal band was only a few hundred kilometers in radius (Whallon 2006), the challenge facing postglacial hunter-gatherers in the Yellow Sea Basin and the peninsula rapidly spread through the region like a domino effect.

If the subsistence failure suffered by local bands could not be absorbed into the regional level, the subsequent population decline would have forced the dwindling groups to move and merge with one another, which would have had a major impact on the regional network. As discussed, we can estimate that fewer than 100 local bands inhabited the peninsula during the final Pleistocene. As the peninsula environment emerged, resources would have become increasingly unpredictable, thus altering the spatial demographic structure. The population dropped significantly in the Korean Peninsula, and of course, there could be no influx from the south, due to the rising Yellow Sea and increasing distance from the Japanese Archipelago.

While I would not go so far as to propose that the peninsula became completely uninhabited, it is extremely likely that the population in the southern peninsula decreased significantly. The drastic drop in population density was likely caused primarily by "population packing" in newly emerging resource patches, particularly riverine and estuarine areas, in the lower Amur, where a few final Pleistocene and early Holocene sites have been recognized.

However, it is important to note that the complete abandonment of the previous habitat would not have been a profitable strategy for highly mobile hunter-gatherers. Foraging bands with a larger range of logistical food supplies could have continued to make infrequent visits and seasonal trips to the southern peninsula, and they could be archaeologically represented by limited activity stations (Binford 1980). Also, we cannot exclude the possibility of human occupations in the southern coastal areas, given the postglacial Gosan-ri site in Jeju.

Conclusion

While "absence of evidence" does not equate to "evidence of absence," the substantial increase in archaeological field research over the last two decades indicates that it is time for archaeologists to consider why we do not have unequivocal evidence of postglacial occupation in the Korean Peninsula. The present essay presents a hypothesis explaining the paucity of the archaeological record by considering the population dynamics of mobile hunter-gatherers.

Based on archaeological applications of ethnographic research on foraging groups from around the world, I assume that, during the final Pleistocene, the Korean peninsula was occupied by a small number of well established regional networks, consisting of local mobile bands exchanging materials, information, and personnel. Given the lowered sea level during the Last Glacial, maximum many foraging bands in Korea would have established networks with other bands in the region now covered by the Yellow Sea. Postglacial environmental change in Korea is characterized by the emergence of peninsular geography, as the rising sea level formed the Yellow Sea and increased the distance between the Korean peninsula and the Japanese Archipelago. The rising sea level and diminishment of productive habitats must have been a substantial challenge to the foraging groups who once inhabited the region now covered by the Yellow Sea.

Given the tight subsistence schedule and spatial alliance networks that hunter-gatherers typically establish (Kelly 1995; Whallon 2006; Wobst 1974), the extensive deterioration of resource habitats in the Yellow Sea Basin forced groups to increase the distance and frequency of their foraging excursions. Such frequent, large scale residential and logistic moves likely caused domino effects that rippled through the other mobile bands in the alliance network. In this case, the southern Korean Peninsula may have witnessed a significant population drop, as new regional networks were established around the new resource patches, in turn providing the basis for early Neolithic cultures in and around the Korean Peninsula.

While extensively rewritten by the author, the present paper represents a revised English version of "Hunter-Gatherer Mobility and Postglacial Cultural Change in the Southern Korean Peninsula," which was previously published in 2008 in *Journal of Korean Archaeological Society* (한국고고학보) 72.

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