7 LATE PLEISTOCENE MICROLITHIC ASSEMBLAGES IN KOREA

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INTRODUCTION: MICROLITHIC SITES AND ARTIFACTS IN KOREA

The terminal Pleistocene lithic industries in Korea and adjacent Northeast Asia are dominated by microblade technology. This may suggest that the microlithic adaptation was a general feature of the Late Pleistocene, at least in the Old World, which in turn leads to the conclusion that the growing microlithization toward the end of the Pleistocene is one of the most conspicuous aspects of the evolution of Palaeolithic technology (Kuhn and Elston 2002).

Despite the lack of a universally accepted definition, the term 'microlith' is widely used in denoting small stone artifacts, especially very small and thin blades and related artifacts (An 1978). The term "microlithic assemblage" in turn became generally reserved for indicating those lithic assemblages containing microblades and microcores. While one may adopt different criteria in describing how small microliths are, microblades in Northeast Asia are usually 15–50 mm long, 4–7 mm wide, and 1–2 mm thick (Gai 1985; Kato and Tsurumaru 1980; Seong 1998). Microblades were probably mounted in wood or antler shafts as barbs and were also used as spears, darts, and, less likely, arrowheads, indicating that tools with mounted microblades were primarily used for hunting and related activities.

In Korea, most lithic assemblages dating to the terminal Pleistocene contain either microblade cores (or microcores), microblades, or both. Previously, microblade cores were described as boat-shaped artifacts in the Korean literature. However, we do not have a long research history studying microlithic assemblages, although more than 40 years have passed since the first Palaeolithic site, Sokchang-ri (Figure 7.1), in the southern part of the Korean Peninsula, was excavated in the early 1960s (Sohn 1973). Sokchang-ri, in fact, yielded a significant number of microliths, including nine microcores, and the Upper Palaeolithic horizon is dominated by a microlithic assemblage (Figure 7.2). In spite of this, the Sokchang-ri microliths did not command the attention they deserved until the late 1980s and early 1990s. The Upper Palaeolithic site of Suyanggae, excavated in the mid-1980s, produced 195 microcores and numerous microblades, according to the excavator (Lee 1984, 1985, 1989c). Most of the Suyanggae microliths were made of siliceous shale, while obsidian was also used in producing microblades and other artifacts. The tools associated with the microliths at Suyanggae include various end-scrapers and tanged points, together with large tools such as handaxes and choppers. While some have raised the possibility that Suyanggae may represent multiple occupational episodes (e.g., Matsufuji 1998), the association of tanged points and microliths is well reflected by many other collections as discussed below.

Further south, the Juam Dam archaeological salvage expeditions exposed a series of Upper Palaeolithic sites along the Boseong River, and sites yielding microliths include Juksan (Yi *et al.* 1990b), Geumpyeong (Lim and Yi 1988), Gokcheon (Lee *et al.* 1988), and Daejeon (Hwasun) (Lee *et al.* 1988; Lee and Yun 1992b) (Figure 7.1).

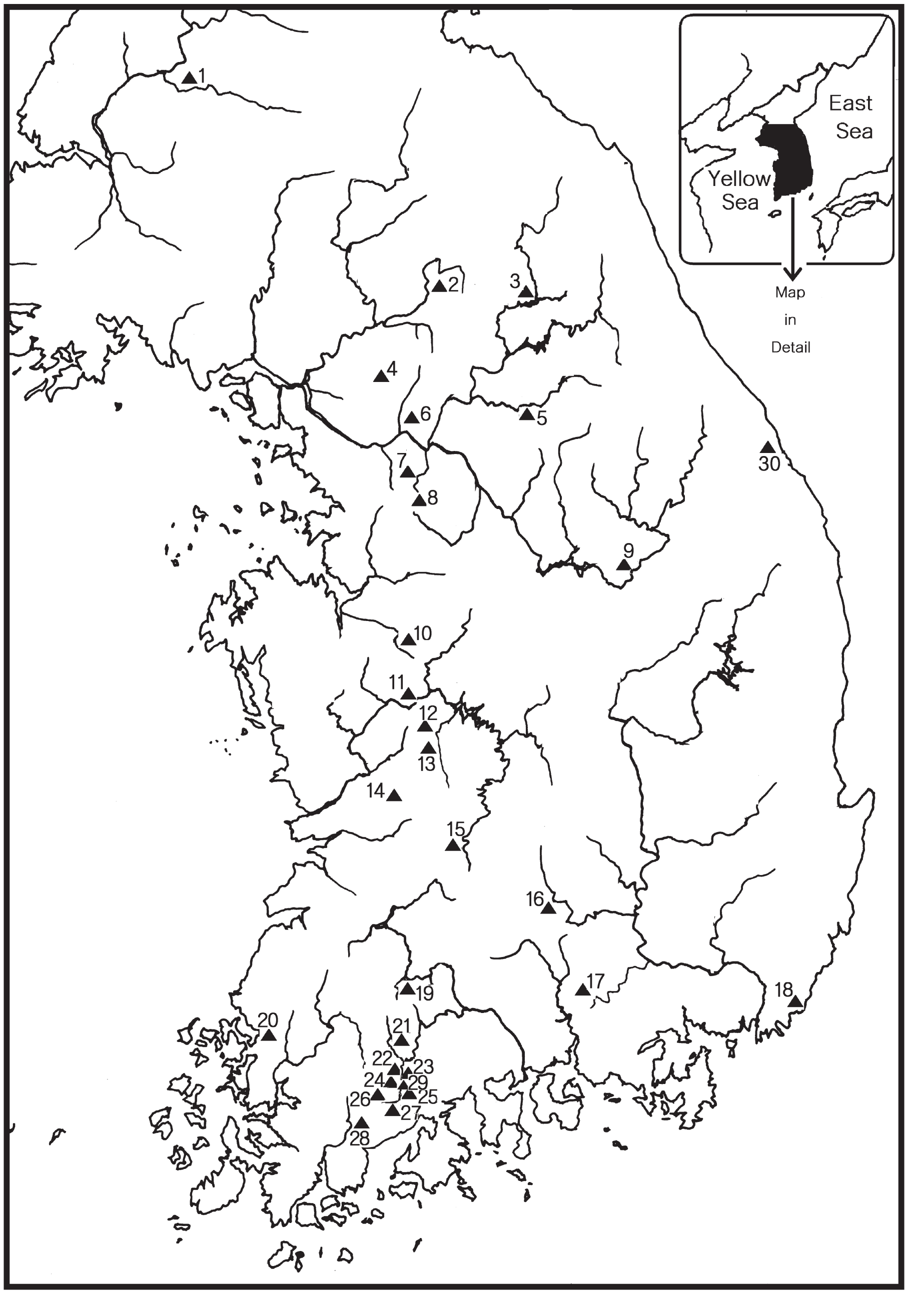

Figure 7.1: Approximate locations of microlithic sites in the Korean Peninsula (administrative position of sites is indicated in brackets). 1. Mandal-ri (Pyongyang); 2. Jangheung-ri (Cheolwon); 3. Sangmuryong-ri (Yanggu); 4. Minrak-dong (Euijeongbu); 5. Hahwagye-ri (Hongcheon); 6. Hopyeong-dong (Namyangju); 7. Sam-ri (Gwangju); 8. Pyeongchang-ri (Yongin); 9. Suyanggae (Danyang); 10. Cheongdang-dong (Cheonan); 11. Sokchang-ri (Gongju); 12. Noeun-dong (Daejeong-dong); 13. Daejeong-dong (Daejeon); 14. Sinmak (Iksan); 15. Jingeuneul (Jinan); 16. Imbul-ri (Geochang); 17. Jiphyeon (Jinju); 18. Jung-dong (Busan); 19. Songjeon-ri and Jusan-ri (Okkwa, Gokseong); 20. Danghasan (Hampyeong); 21. Daejeon (Hwasun); 22. Geumpyeong (Suncheon); 23. Juksan (Suncheon); 24. Gokcheon (Suncheon); 25. Wolpyeong (Suncheon); 26. Yongso (Boseong); 27. Donggoji (Boseong); 28. Sinbuk (Jangheung); 29. Geumseong (Suncheon); 30. Gigok (Donghae).

Microliths subsequently drew increased attention, and several archaeologists began to tackle the issue of microblade techniques (Lee 1989c; Lee and Yun 1994; Seong 1990, 1998). Since the early 1990s, more microlithic sites have become known in Jeollanam-do Province in the southwestern corner of the Korean Peninsula than in any other region of Korea, including the recent addition of important collections from the Wolpyeong and Sinbuk sites (Lee 2002a, 2004) (Figure 7.1). This is because the Palaeolithic archaeological expeditions in the Jeollanam-do area were based on extensive surface surveys along the Boseong River (Lee 1997). Recently, more than 100 microblade cores were collected at the Sinbuk site as well as various types of endscrapers, burins, tanged points, and ground stone axes (Lee 2004). Most of the microliths from the southern part of the peninsula were made of silicified tuff or shale, in contrast to obsidian artifacts from central and northern Korea (Seong 1998, 2004a, 2004b).

In the central part of Korea, the Hahwagye-ri and Sangmuryong-ri sites, located along the Bukhan River, were excavated during the late 1980s and early 1990s and yielded many microliths (Choi 1989; Choi *et al.* 1992) (Figure 7.1). Especially noteworthy is that obsidian artifacts are predominant in the Hahwagye-ri microlithic assemblage, as they are widely recognized in collections from the central part of the Korean Peninsula, like those from Hopyeong (Hong *et al.* 2002), Minrak-dong (Choi *et al.* 1996), Sam-ri (Han *et al.* 2003a), and Mandal-ri near Pyongyang (Kim *et al.* 1990) (Figure 7.1). In a recent

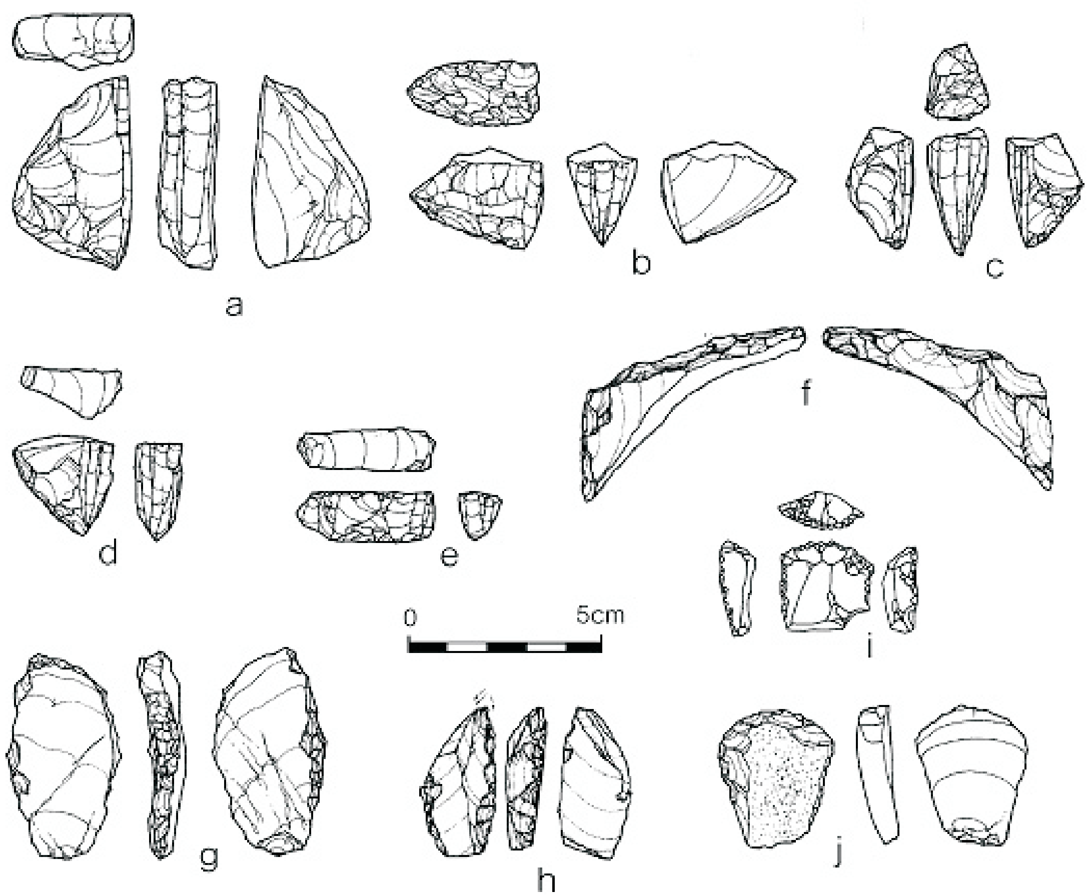

Figure 7.2: Microblade cores and associated artifacts from Sokchang-ri.
a–g: microblade cores and related flakes; h: burin; i and j: endscrapers (modified, based on Jang 2002).

excavation at Hopyeong, numerous microliths, made of obsidian and siliceous shale, were recovered along with other types of very small artifacts, including "microdrills" and tanged points (Hong *et al.* 2002). Palaeolithic sites located along the east coast of Korea have also yielded microliths, as exemplified by a recent excavation of the Gigok site (Lee *et al.* 2005). Obsidian was regularly exploited to produce microliths in northern and central Korea at the end of the Pleistocene in contrast to the southern part.

Despite the brief history of microlithic research, there are some 30 microlithic sites and vast microlithic collections from many archaeological sites throughout the Korean Peninsula (Figure 7.1). Among them, sites yielding ten or more microcores include Hahwagye-ri, Hopyeong, Suyanggae, Wolpyeong, and Sinbuk (Table 7.1). It also needs to be pointed out that excavation reports are currently not available for such important microlithic sites as Hopyeong, Jiphyeon, Jangheung-ri, and Sinbuk.

VARIOUS MICROBLADE TECHNIQUES

Reconstruction of microblade manufacturing techniques on the basis of microcore morphology has been one of the central themes in the study of the microlithic tradition in Korea (e.g., Kim 2002; Jang 1995; Jang 2002; Lee and Yun 1994; Lee *et al.* 1996; Seong 1998) and adjacent countries (e.g., Chen 1984; Chen and Wang 1989; Kato 1992; Lu 1998). The term "tradition" is used here to denote the persistence of largely the same kind of technology through time. The term "wedge-shaped" core is widely used to indicate those cores with a relatively long and slender fluted or blade producing surface, while boat-shaped cores are relatively thick and wide with a rather short fluted surface. However, as I have pointed out elsewhere (Seong 1998), the distinction between wedge-shaped and boat-shaped cores has no sound basis and is often used arbitrarily.

Thanks to Japanese archaeologists, more than 10 specific techniques of producing microblades were reconstructed (Kobayashi 1970; Kato and Tsurumaru 1980; Obata 1987), and most of them are also recognized by Chinese scholars (Chen and Wang 1989; Tang and Gai 1986). These current technological typologies, however, are often overly specific and do not effectively represent the full range of variation. For example, not a few microblades were produced from casual cores, which does not receive due consideration in the current fixed typology. Instead, an analysis of core reduction technology would be best examined if one is mainly concerned with the reduction sequence based on specific stages towards microblade production. According to many useful studies of microblade techniques, three more or less successive stages can be recognized: blank formation, platform preparation, and blade detachment.

There are technological varieties of each of these three steps, and varieties from each step denote various microblade production techniques, such as the Yubetsu, Togeshita, and Hirosato techniques, as recognized by Japanese archaeologists. Given the sophistication of microblade technology, the sequence of core preparation is often determined from the very beginning, and the first step, blank selection and preparation, may result in recognizable differences in the final product. In a broad sense, four types of blank formation are recognized: bifacial, unifacial, conical, and large.

Microcores manufactured on bifacially prepared blanks are often elongated and of oval shape, as exemplified by many of the Suyanggae specimens (Figure 7.3). Called type 1 here, they are usually larger than other types of microcores. Microblade cores that can be assigned to type 2 are in turn often smaller than type 1 cores. Some type 2 cores were unifacially flaked, while others lack any apparent evidence of further flaking and trimming of the face (Figure 7.4: b, d, e). Conical or cylindrical cores which belong to type 3 (Figure 7.4: f) are characterized by a different reduction trajectory than type 1 and 2 cores: the platform was often produced first with subsequent working of the surface. A significant amount of trimming around the platform was required before blade detachment. Large blades or elongated flakes were also worked into microblade cores (type 4), and they reveal a similar morphology to burins as demonstrated by many specimens from the Hahwagye-ri site.

The next step in microblade technology is the preparation of the platform. In a broad sense, three types are recognized: (a) longitudinal detachment of so called ski-spalls (Figures 7.2: f; 7.3: f; 7.4: b), (b) side blow and subsequent trimming, and (c) opportunistic or no further trimming around the platform. A typical Yubetsu technique often recognized by Japanese scholars is the combination of type 1 blank formation and type (a) platform preparation as shown by the Suyanggae specimens (Figure 7.3: e-j).

Microblade detachment is mostly confined to one edge of the core, but may also occur on both ends (Figure 7.4: k) or circumferentially. An exhausted core may have an acutely angled blade

Figure 7.3: Microblade cores from the central part of the Korean Peninsula.
a: Mandal-ri; b: Jangheung-ri; c: Pyeongchang-ri; d: Sangmuryong-ri; e–j: Suyanggae (d, e, f, i, and j after Obata 2004:37).

Table 7.1: Microlithic sites and artifacts in the Korean Peninsula.

	Site	Microliths	Raw material	Date (^{14}C)	Other artifacts	Source
1	Mandal-ri	5 mcores*	Obsidian	no data	Obsidian flakes	Kim *et al.* (1990); Seo (1987)
2	Jangheung-ri	5 mcores	S. shale**, obsidian	24,200 ± 600 BP (SNU00-380); 24,400 ± 600 BP (SNU00-381)	Tanged point	Choi (2001)
3	Sanjuryong-ri	2 mcores, mblades	Obsidian, s. shale	no data	Burins	Choi (1989)
4	Minrak-dong	1 mcore	Obsidian	no data	Obsidian flakes, quartz, crystal core	Choi *et al.* (1996)
5	Hahwagye-ri	27 mcores	Obsidian	no data	Burins, endscrapers	Choi *et al.* (1992)
6	Hopyeong (Hopyeong-dong)	10 mcores, mblades	Obsidian, s. shale	22,200 ± 600 BP (SNU02-327); 21,100 ± 200 BP (SNU02-329); 17,500 ± 200 BP (SNU02-325); 17,400 ± 400 BP (SNU02-326); 16,900 ± 500 BP (SNU02-324); 16,600 ± 720 BP (GX-29423); 16,190 ± 50 BP (GX-29424)	Burins, endscrapers, awls, tanged points, microdrills	Hong *et al.* (2002)
7	Sam-ri	15 mblades	S. shale	no data	Tanged point, burin	Han *et al.* (2003a)
8	Pyeongchang-ri	1 mcore (surface collection)	S. shale	no data	Platform rejuvenation flake	Yi *et al.* (2000)
9	Suyanggae	195 mcores, mblades	S. shale, obsidian	c. 18,630 BP (UCR-2078); c. 16,400 BP (no Lab No. provided)	Tanged points, end-scrapers, handaxes, choppers	Lee (1984, 1985, 1989c); Lee and Yun (1992a)
10	Cheongdang-dong	1 mcore (surface collection)	S. shale	no data	n.a.	Unpublished
11	Sokchang-ri	9 mcores	S. shale, porphyry	20,830 ± 1880 BP (AERIK-8)	Tanged point, end-scrapers	Sohn (1973)
12	Noeun-dong	1 mcore	S. shale	no data	Burins, endscrapers	Han *et al.* (2003b)
13	Daejeong-dong (Daejeon)	1 mcore	S. shale	19,680 ± 90 BP (GX-28422)	Bifacial point	Lee *et al.* (2002)
14	Sinmak	1 mcore (surface collection)	S. shale	no data	Burin, flakes	Kim (2002)

15	Jingeuneul	mblades	S. shale	22,850±350 BP (SNU01-028)	Tanged points	Lee (2001)
16	Imbul-ri	2 mcores	n.a.	no data	Flakes	Nakayama (1989)
17	Jiphyeon Jangheung-ri	Numerous mcores	S. shale	no data	Ground stone axe	Park and Seo (2004)
18	Jung-dong	3 mcores	S. shale	no data	Endscraper, quartzite flakes	Ha (1999)
19	Songjeon-ri (Okkwa County)	2 mcore (surface collection)	S. shale	no data	Ski-spall, refitted to mcore, endscrapers, chopper	Yi *et al.* (1990a)
20	Danghasan	4 mcores	S. shale	no data	Blades and flakes	Choi and Lee (2001)
21	Daejeon (Hwasun)	3 mcores	S. shale	no data	Scraper	Lee and Yun (1992b), Lee *et al.* (1988)
22	Geumpyeong	1 mcore	S. shale	no data	Endscraper	Lim and Yi (1988)
23	Juksan	1 mcore	S. shale	no data	Burin, tanged point	Yi *et al.* (1990a, 1990b)
24	Gokcheon	2 mcores	S. shale	no data	Ski-spalls	Lee *et al.* (1988)
25	Wolpyeong	22 mcores, mblades	S. shale, quartz crystal	no data	Bifacial points, tanged point	Lee (2002a, 2002b)
26	Yongso	1 mcore	S. shale	no data	n.a.	Kim (2002)
27	Donggoji	1 mcore	S. shale	no data	n.a.	Lee (1997)
28	Sinbuk	More than 100 mcores	S. shale, obsidian, quartz crystal	25,500±1000 BP (SNU03-914); 25,420±190 BP (SNU03-569); 21,760±190 BP (SNU03-913); 20,960±80 BP (SNU03-568); 18,540±270 BP (SNU03-915); 18,500±300 BP (SNU03-912)	Tanged points, bifacial points, burins, endscrapers, ground stone artifacts, including axe	Lee (2004)
29	Geumseong	1 mcore	S. shale	no data	n.a.	Kim (2002)
30	Gigok	mcore, mblade	Obsidian, porphyry, quartz crystal	10,200±60 BP (SNU02-542)	Burins, points, awls, endscrapers	Lee *et al.* (2005)

* Mcore, mblade indicate microcore and microblade, respectively.

** Raw material labeled as S. shale is "siliceous shale" or "silicified tuff". While many excavation reports describe the rock as mudstone, hornfels, rhyolite, or andesite, it is likely to represent a similar rock type that could collectively be called 'siliceous shale' or 'silicified tuff' (Seong 2004a, 2004b).

producing surface to the platform (Figure 7.3: h). It also seems that type 1 microcores with bifacial preparation, which are relatively larger than other types, are more or less antecedent to the type 2 and 3 cores (Seong 1998).

ARTIFACTS ASSOCIATED WITH MICROLITHS

Microlithic assemblages in Korea not only contain various small artifacts such as endscrapers, sidescrapers, burins, points, and awls, but also large stone artifacts such as choppers and even handaxes, as exemplified by the Suyanggae collection. Large tools were often made from vein quartz and quartzite cobbles, while small artifacts and microliths were manufactured on such fine-grained rocks as siliceous shale or tuff, and obsidian. Although large tools such as choppers are included in some assemblages, they are still dominated by microblade technology.

Small endscrapers are regularly associated with microliths. Some 79 endscrapers were collected at Suyanggae, and they are mostly made from siliceous shale as were the microblades and microcores (Lee *et al.* 2001; Lee and Kong 2003;

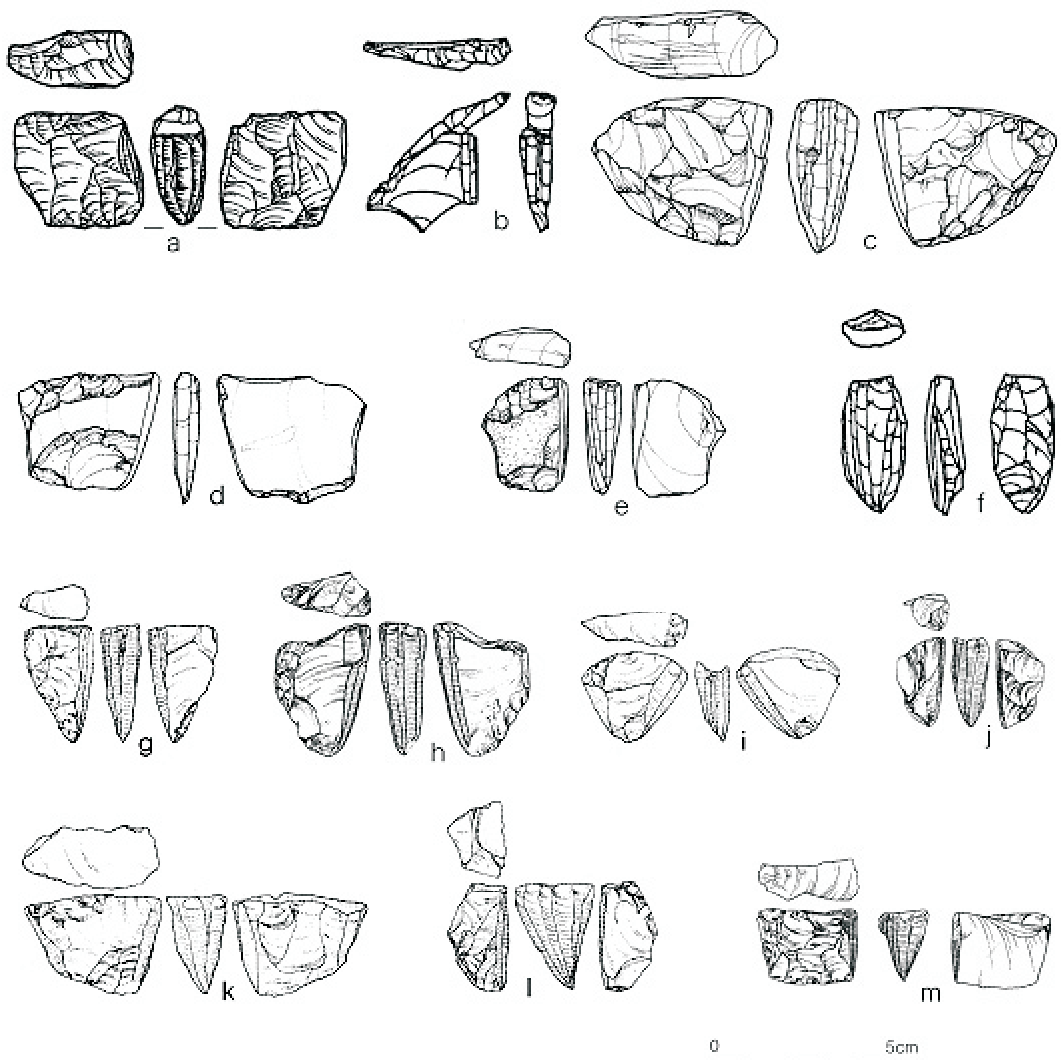

Figure 7.4: Microblade cores from the southern part of the Korean Peninsula.
a: Imbul-ri; b: Songjeon-ri; c–e: Daejeon; f: Geumpyeong; g–m: Wolpyeong (b and f after Jang 2002; c–e after Obata 2004:38; g–m after Lee 2002a).

Figure 7.6: e-f). Various types of endscraper are recognized in terms of the blanks on which they were manufactured, including those with relatively thick flakes and blades as observed in the Wolpyeong (Lee 2002a) and Suyanggae collections.

Tanged points with stemming retouch around the butt are important components in many Upper Palaeolithic assemblages in Korea as well as in western Japan. As shown in Table 7.1, nine microlithic sites have yielded tanged points, including Jangheung-ri, Hopyeong, Sam-ri, Suyanggae, Sokchang-ri, Jingeuneul, Juksan, Wolpyeong, and Sinbuk (Figure 7.5). Tanged points were also discovered at some other Upper Palaeolithic sites, such as Hwadae-ri, Yongho-dong, Yongsan-dong, and Gorye-ri, without being associated with microliths (Obata 2004). At the stratified site of Yongho-dong, a tanged point was unearthed from a layer beneath a horizon that was dated to c. 38,000 BP (Han 2002).

In addition, bifacial points, much larger than tanged points, were collected at the Suyanggae, Daejeong, Sinbuk, and Wolpyeong sites (Lee 2002a, 2004; Figure 7.5: f-g). Recently, ground stone artifacts were also found associated with microliths at several Upper Palaeolithic sites. At Sinbuk, a ground stone axe and other types of ground stone artifacts were found in the same cultural horizon as microliths (Lee 2004). A ground stone axe was also collected at the Jiphyeon site with many microcores and microblades (Park and Seo 2004) (Table 7.1).

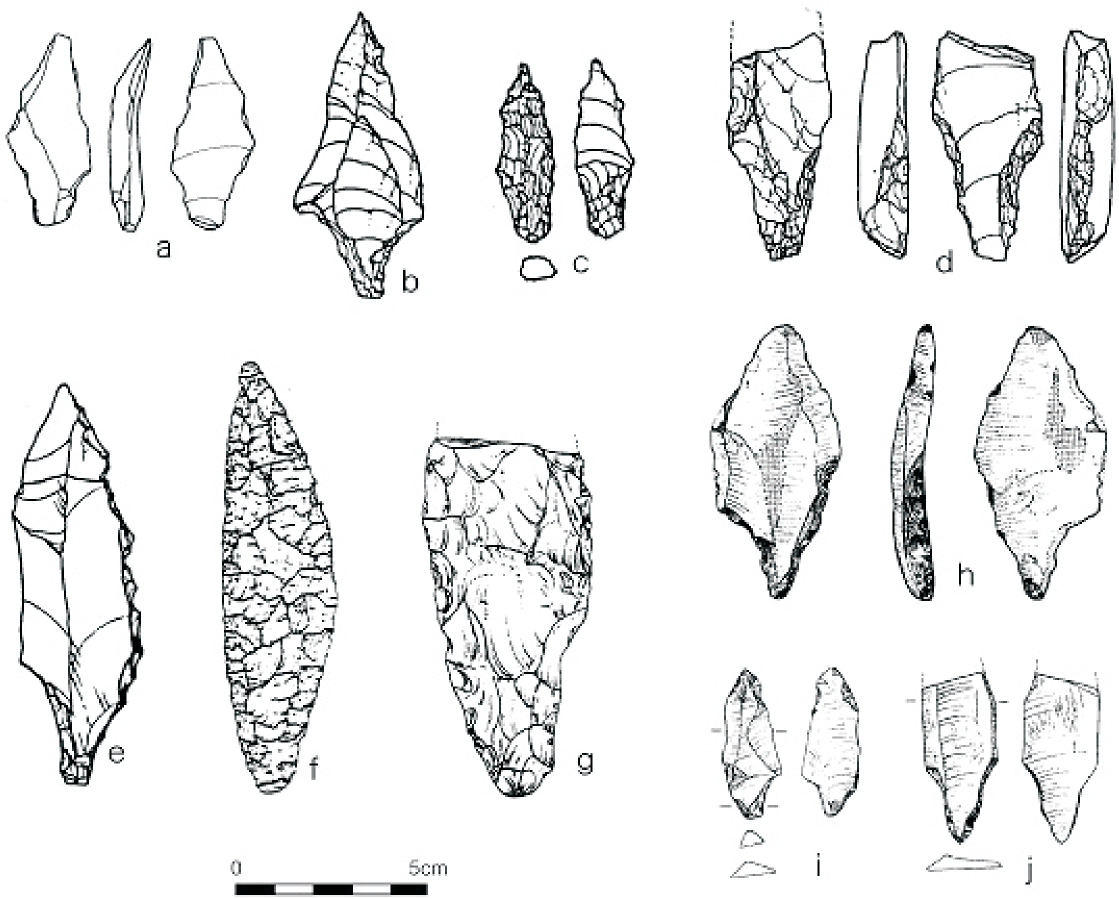

Figure 7.5: Tanged points and bifacial points associated with microliths in Korea.
a: Jangheung-ri; b-c, e: Suyanggae; d, f: Sokchang-ri; g-j: Wolpyeong (b, c, e and f after Jang 2002; g-j after Lee 2002a).

Other interesting and important microliths associated with microcores and microblades include microdrills. At a recent excavation of the Hopyeong site near Seoul, a number of obsidian microdrills were unearthed along with endscrapers and burins. Burins are also regularly associated with microliths as exemplified by the illustrated artifacts from Sokchang-ri (Figure 7.2) and Sangmuryong-ri (Figure 7.6; Table 7.1).

CHRONOLOGY OF MICROLITHIC ASSEMBLAGES

Given that the microlithic tradition marks the Final Pleistocene lithic technology, it seems plausible to assume that microblade technology was established based on the advanced technology of the blade (i.e., not microblades, but large or normal sized blades) industry. While the Upper Palaeolithic, or Late Palaeolithic, is traditionally defined by the dominance of blade technology in lithic assemblages, we do not have clear evidence of this before c. 30,000 BP in Korea.

Only a small amount of archaeological data has been recovered that can be grouped into the blade industry preceding the microlithic one. Nevertheless, the Gorye-ri assemblage from the southeastern corner of the Korean Peninsula contains large blades, blade cores, and tanged points made on blades (Jang 2001; Seo *et al.* 1999), and so do the recent collections from Hwadae-ri (KNUM 2003), Yongho-dong (Han 2002), and Yongsan-dong (JICP 2004).

A few AMS ^{14}C dates show that these blade assemblages are dated to c. 40,000–27,000 BP, and thus, it is safe to say that the blade assemblages predating the microlithic assemblages are commonly characterized by such artifacts as blades,

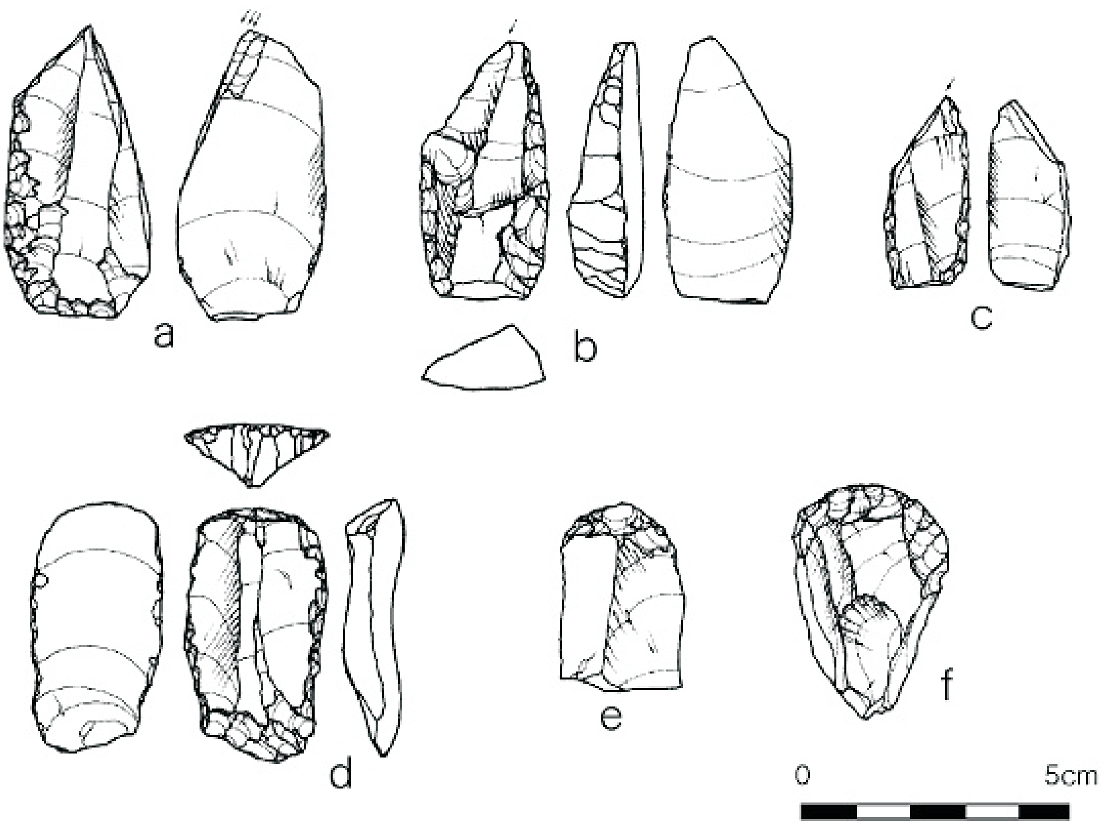

Figure 7.6: Burins and endscrapers associated with microliths in Korea.
a-d: Sangmuryong-ri; e-f: Suyanggae (after Obata 2004:37-38).

blade cores, and, importantly, tanged points. Tanged (or stemmed) points may have some chronological significance, given that they largely predate the microlithic assemblages in western Japan (Matsufuji 2001; Obata 2004). Most of the Gorye-ri artifacts were collected from the deposit above the AT tephra horizon where the AT volcanic ash samples, originating from southern Kyushu Island and dated to c. 25,000–24,000 BP, were collected (Seo *et al.* 1999).

Until the 1990s, only a few chronometric dates for the microlithic tradition were available. The Sokchang-ri artifacts were recovered from a layer immediately below a deposit dated to around 20,000 BP (Sohn 1993), and Suyanggae provided ^{14}C dates of c. 18,630 BP and c. 16,400 BP. Recent progress, however, offers a basis on which we can discuss the time span of the microlithic tradition in Korea.

Despite the insufficient number of absolute dates, it appears that microlithic assemblages are dated to Oxygen Isotope Stage (OIS) 2 and that the microlithic tradition was established by the time of Last Glacial Maximum (LGM), around 20,000 BP. This is well indicated in Table 7.1, which shows the available ^{14}C dates of microlithic sites of the Korean Peninsula. The Jangheung-ri cultural horizon containing microliths yielded two AMS dates of 24,400 ± 600 BP and 24,200 ± 600 BP (Choi 2001), which are among the earliest dates for microlithic assemblages in Northeast Asia (see Kuzmin, this volume). The latest development in chronology of the early microblade complexes in Korea is that the Sinbuk site has the earliest microblade associated ^{14}C date in Korea at c. 25,400 BP (Lee 2004) (Table 7.1). The microlith-bearing horizons at Sockchang-ri (Sohn 1993), Jingeuneul (Lee 2001), Hopyeong (Hong *et al.* 2002), and Daejeon (Lee *et al.* 2002), were dated to c. 22,800–20,000 BP (Table 7.1). Thus, there is no doubt that the emergence of microlithic assemblages extends back to at least 20,000 BP in Korea, and that the microlithic adaptation had become widespread by the onset of the LGM. Table 7.1 also summarizes artifacts associated with microblades and microcores.

The association between the microlithic assemblage and ^{14}C date at Sockchang-ri is unclear. From the description in Sohn (1993) and other literature, the dated sample was likely to have been taken beneath the microlithic horizon. This is, however, based on the interpretation of the vertical stratigraphic profile, rather than the stratigraphic association between the sample and artifacts.

From a very sketchy perspective based on the scale of assemblage comparison, microlithic assemblages containing large blades and tanged points may represent the earlier phase of the microlithic tradition, while those without tanged points indicate the later phase. The earlier microlithic phase may be dated to the last full glacial, approximately 25,000–17,000 BP, as shown by the radiometric dates from Sinbuk, Jingeuneul, Jangheung-ri, Hopyeong, and Suyanggae, where tanged points were found associated with microliths. The later phase of the microlithic tradition may span the rest of the Late Pleistocene, as the ^{14}C date from the Gigok site indicates.

In sum, the Upper Palaeolithic blade and microblade assemblages of Korea show three more or less successive phases: 1) assemblages characterized by blades and tanged points without microliths; 2) assemblages marked by the association of tanged points and microliths; and 3) assemblages with microliths and without tanged points. The first phase is represented by the Hwadae-ri, Yongho-dong, Yongsan-dong, and Gorye-ri sites; the second phase by the Jangheung-ri, Hopyeong, Suyanggae, Sockchang-ri, Jingeuneul, Wolpyeong, Sinbuk, and Juksan sites; and the third phase by the Hahwagye-ri, Gigok, and Jiphyeon Jangheung-ri sites.

THE MICROLITHIC EVOLUTION

While the microlithic tradition characterizes the late Upper Palaeolithic industries, it is not clear when and why it emerged and became established on the Korean Peninsula. Many scholars assume that the microlithic tradition first appeared in the north and then diffused to the south (Kato 1992; Lee 1999), but I do not agree with this simple diffusionist point of view (Seong 2000, 2001). Rather, as I discussed above, little difference in the early dates of microlithic assemblages between northern China and Korea can be recognized (see also Kuzmin, this volume; Keates, this volume). Furthermore, during the last glacial, the Korean Peninsula was simply part of the continent given that the sea shelf of the modern day Yellow Sea was exposed. We cannot, and need not, pinpoint where microblade technology initially originated, and, instead, the research focus should be placed on the ecological and evolutionary processes behind the establishment of the microlithic tradition. Although we do not have sufficient evidence, it would be more reasonable to view the establishment of microlithic technology from an evolutionary perspective focusing on the ecological conditions prompting the high mobility of Late Pleistocene hunter-gatherers.

The distribution of microlithic assemblages in Northeast Asia is largely confined to the northern latitudes, which strongly suggests that the microlithic tradition was closely associated with human adaptation to cold and harsh environments (Elston and Brantingham 2002; Jang 1995; Seong 2000). Given that the emergence of microlithic assemblages could date to the onset of the last full glacial, the hypothesis of cold adaptation is also applicable to the Korean cases as well as northern China and Siberia.

From a behavioural ecological perspective, adaptive responses to harsh environments with an uneven resource distribution are characterized by an increasing dependence on large and medium-sized game. This was the most reliable strategy for last glacial mobile hunter-gatherers (e.g., Kelly 1995; Kuhn and Stiner 2001). Tanged points and microblades were considered as parts of the hunting equipment: a tanged point was likely used individually and inserted into the haft of a projectile weapon, while a series of microblades constituted a composite tool. It is generally thought that microblades were attached to a bone or antler shaft as marginal insets for projectile points and knives, which represent very durable and reliable tools in a harsh environment as Elston and Brantingham (2002) have proposed. While both tanged points and microblades were used in the earlier phase of the microlithic tradition, they were probably used for hunting relatively large and medium-sized game, which was essential for the survival of mobile hunter-gatherers during the LGM. As for the dispersal of microlithic technology, it is likely that high mobility in harsh and unpredictable environments in turn triggered the spread of microblade technology in a relatively short period of time.

The archaeological evidence suggests that tools with microblades dominated the hunting equipment used after the LGM, the period characterized by fluctuating climates and increasing seasonality (COHMAP Project Members 1988). This probably resulted in a situation where high-ranked resources became exhausted regionally due to migration and changing environments, with hunter-gatherers responding by widening their dietary breadth (Kelly 1995). Microblade tools may have been primarily used for hunting large and medium-sized game, but they were also likely to have been used for a variety of other purposes. Low-ranked resources, including small mammals and plant seeds, or even fish, may have been increasingly targeted by post-LGM hunter-gatherers. In this vein, multi-functional composite tools using microblades represented a risk-minimizing strategy in unpredictable environments. This explanation is well applicable to the Korean Palaeolithic data in which assemblages dated to the height of OIS 2 (c. 24,000–17,000 BP) contain both tanged points and microliths, while those dated to c. 17,000–10,000 BP are dominated by microliths and related artifacts without tanged points.