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The Initial Spread of Early Agriculture into Northeast Asia

Miyamoto Kazuo

Abstract: The emergence of millet agriculture in the Russian Far East and in the southern coastal area of the Korean Peninsula not only have similar dates of ca. 3400 cal BC, but are both also accompanied by a change in pottery styles and the introduction of northern Chinese style agricultural stone tools. The spread of millet agriculture to the southern Russian Far East from the inland area of the upper Mudanjiang River valley and to the southern, eastern coastal areas from the northwest Korean Peninsula at about 3400 cal BC was the first stage of early agriculture in Northeast Asia, and this spread may have been caused by climatic cooling. Foragers who were acculturated with northern Chinese agriculture in the northwestern Korean Peninsula and in the inland Russian Far East area respectively migrated to the southern Korean Peninsula and to the coastal area of the southern Russian Far East, bringing millet with them.

Key Words: early agriculture; millet; the Russian Far East; the southern Korean Peninsula; Voisman; Khanxi; Krounovka; Zaisanovka; Yaburi; Jeulmun pottery; stone pestles; stone mortars

Introduction

Northeast Asia, comprised of the southern Russian Far East, the Korean Peninsula, and the Japanese archipelago, is known to have had prehistoric period agriculture, with crops such as millet, wheat, and rice, but the origins of this complex are not well known. Millet agriculture began in northern China, while rice was domesticated in southern China. Among the earliest millet is broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) dating to 8000–7600 cal BP from Xinglonggou 兴隆沟 in the Liaoxi 辽西 district of Inner Mongolia (Zhao 2005) and Yuezhuang 月庄 in Shandong (Crawford et al. 2013). In adjacent Northeast Asia, there were no similar innovations in cereal domestication, except possibly for barnyard grass (*Echinochloa crus-galli*). Northeast Asia is, therefore, a region of secondary agricultural origins and apparently received cereal agriculture from regions of the Chinese continent.

I have hypothesized that there were four stages in the development of agriculture in Northeast Asia during prehistoric times (Miyamoto 2014). The first stage involved the

spread of millet agriculture from Northeast China to the Korean Peninsula and to the southern Russian Far East in the middle of the fourth millennium BC. The second stage was the spread of wet-rice agriculture from the Shandong Peninsula to the Liaodong Peninsula in the latter half of the third millennium BC. At the same time, the Pianpu 偏堡 Culture spreads from the eastern Liaoxi district through the Liaodong 辽东 district to the northwestern Korean Peninsula (Miyamoto 2015). The third stage was the spread of irrigated agriculture associated with new polished stone tools, including reaping knives and flat plano-convex stone adzes. The third phase saw the introduction of a third agricultural system consisting of wet (rice) and dry (millets and wheat, etc.) fields. This irrigated agriculture also spread from the Shandong Peninsula through the Liaodong Peninsula to the Korean Peninsula in the middle of the second millennium BC. Finally, the fourth stage involved the spread of irrigated agriculture to northern Kyūshū, Japan, beginning around the eighth century BC.

This paper focuses on the earliest developments in Northeast Asia, that is, the first stage.

New data from Northeast Asia are providing a clearer perspective on four questions. (1) When was the first agriculture introduced into Northeast Asia? (2) What was the nature of this agriculture system? (3) What kinds of crops were cultivated? And (4) How important were these crops to the people in the region? Furthermore, I examine how and why agriculture spread into these regions.

The Spread of Millet Agriculture to the Korean Peninsula

The earliest evidence of cultigens on the Korean Peninsula is found in the northwestern region of the peninsula. For example, foxtail millet from the Chitamni 智塔里 site and from dwelling pit No. 7 of the Masan 马山 site apparently dates to ca. 4000 BC (Miyamoto 2003). The dating is based on the pottery chronology, with cross-dating to radiocarbon dated sites

containing the same pottery types (Miyamoto 1985) (see Table 1 for the pottery chronology). Northern Chinese style agricultural stone tools, such as mortars, pestles, and hoes, are associated with the millet at these sites. Table 2, which lists archaeological evidence for cereals, shows that agriculture first spread along the western coast of the northwestern Korean Peninsula. Recently, foxtail millet has been recovered from the Tongsamdong 東三洞 site and Neungmok 陵谷 site in the Middle Neolithic period and from the Late Neolithic Sanchonli 上村里 site on the southern coast of the Korean Peninsula (Lee 2011). The foxtail millet from the Tongsamdong site is AMS-dated to 3360 cal BC (Crawford and Lee 2003) and the foxtail millet from the Neungmok site is AMS-dated to 3520±100 cal BC (Lee 2011). The broomcorn millet from the Pyeonggeodong 平居洞 site is AMS-dated to 2970±50 cal BC (Lee 2011).

Table 1. Pottery chronology for the Neolithic Korean Peninsula.

Date	Liaodong	Northwest	Middle-West	Southern Coast	Eastern Coast	North-east	Southern Russian Far East
5000 BC	Xiaozhushan Lower			Initial Neolithic	Osanni B	Sopohan1	Voisman
					Osanni Lower Layer		
4000 BC				Early Neolithic			
	Xiaozhushan Middle	Chitamni 1	Amsadong		Osanni Middle Layer	Sopohan2	
		Chitamni 2		Middle Neolithic	Chigyonni		Early Zaisanovka
3000 BC	Wujiacun					Sopohan3	Middle Zaisanovka
	Pianpu	Namgyon 1	Tunsan	Late Neolithic			
2000 BC	Xiaozhushan Upper	Namgyon 2			Sonjonni	Sopohan4	
	Shuangtuozi 1		Sokudo	Final Neolithic		Sopohan5	Late Zaisanovka

Table 2. Archaeological evidence of millet grains in the Neolithic Korean Peninsula.

Site name	District of Korean Peninsula	Dating	Cereals
Chitamni second area No. 2 pit dwelling	Northwestern	ca. 4000 BC	Foxtail millet or barnyard grass
Masan No. 7 pit dwelling	Northwestern	ca. 4000 BC	Foxtail millet
Namgyong No. 31 pit dwelling	Northwestern	ca. 3000 BC	Foxtail millet
Socheonri No. 4 pit dwelling	Northwestern	ca. 3000 BC	Foxtail millet
Neunggok	Middle-Southern	3520 ± 100 cal BC	Foxtail millet
Tongsamdong No. 1 pit dwelling	Southern	3360 cal BC (4590 ± 100 BP)	Foxtail millet, broomcorn millet
Pyonggeodong	Southern	2970 ± 50 cal BC	Broomcorn millet
Sanchonri B	Southern	2920–2200 cal BC (4060 ± 140 BP)	Foxtail millet, broomcorn millet
Oun 1	Southern	2880–2285 cal BC (4030 ± 100 BP)	Foxtail millet

During the Korean Middle Neolithic, both the northwestern and southern Korean Peninsula share similar pottery styles, polished willow leaf arrowheads, as well as northern Chinese style agricultural stone tools (Figure 1). Before this period, the pottery styles of the Early Neolithic of the Korean Peninsula can be divided into two types: *Jeulmun* 櫛文 pottery of the northwestern Korean Peninsula and *Yunggimun* 隆起文 pottery of the eastern and southern Korean Peninsula. But at the beginning of Korean Middle Neolithic, *Jeulmun* pottery abruptly becomes distributed across the eastern and southern Korean Peninsula as well, while at the same time, *Yunggimun* pottery disappears from this area.

However impressions of millet grains on the pottery sherds found recently indicate that broomcorn millet and foxtail millet already were present in the Initial or the Early Neolithic period in the southern Korean Peninsula (Obata and Manabe 2014). Although the identification of millet in Korean Initial Neolithic pottery sherds is still not clear, it is probable that foxtail millet and broomcorn millet existed in the Early Neolithic period according to the kernel impressions in the pottery. But carbonized millet grains have been found in archeological contexts dating to as early as the Korean Middle Neolithic period (Table 2). It is very important that *Jeulmun* pottery, northern Chinese style

agricultural stone tools, and carbonized millet grains co-existed from the Korean Middle Neolithic period in the southern coast area and the eastern coast areas of the Korean Peninsula.

Use-wear analysis of stone mortars and stone pestles from the southern regions of the Korean Neolithic supports the view that the northern Chinese style agricultural stone tools were used for the same purposes as in their region of origin (Kamijo 2008a). By comparing experimental studies with use wear on the stone tools, Kamijo (2008a) demonstrates that stone pestles and stone mortars were used to de-husk millet grains and to produce flour (e.g., see Figure 2). In Figure 2, a pestle from the Middle Neolithic Chigyonli 地境里 site, in Kwangwondo 江原道, clearly shows evidence of a gloss due to phytoliths from cereals such as millet or rice. The linear traces on the stone pestle mean that there was a fixed direction of movement. The same use wear traces are found on stone mortars and pestles from Early and Middle Neolithic sites in northern China (Kamijo 2008b). This is strong evidence that northern Chinese style agricultural stone tools spread to the Korean Peninsula with millet agriculture. The emergence of domesticated cereals and agriculture-related material culture indicate that millet agriculture was practiced in the southern part of the peninsula by the late fourth millennium BC.

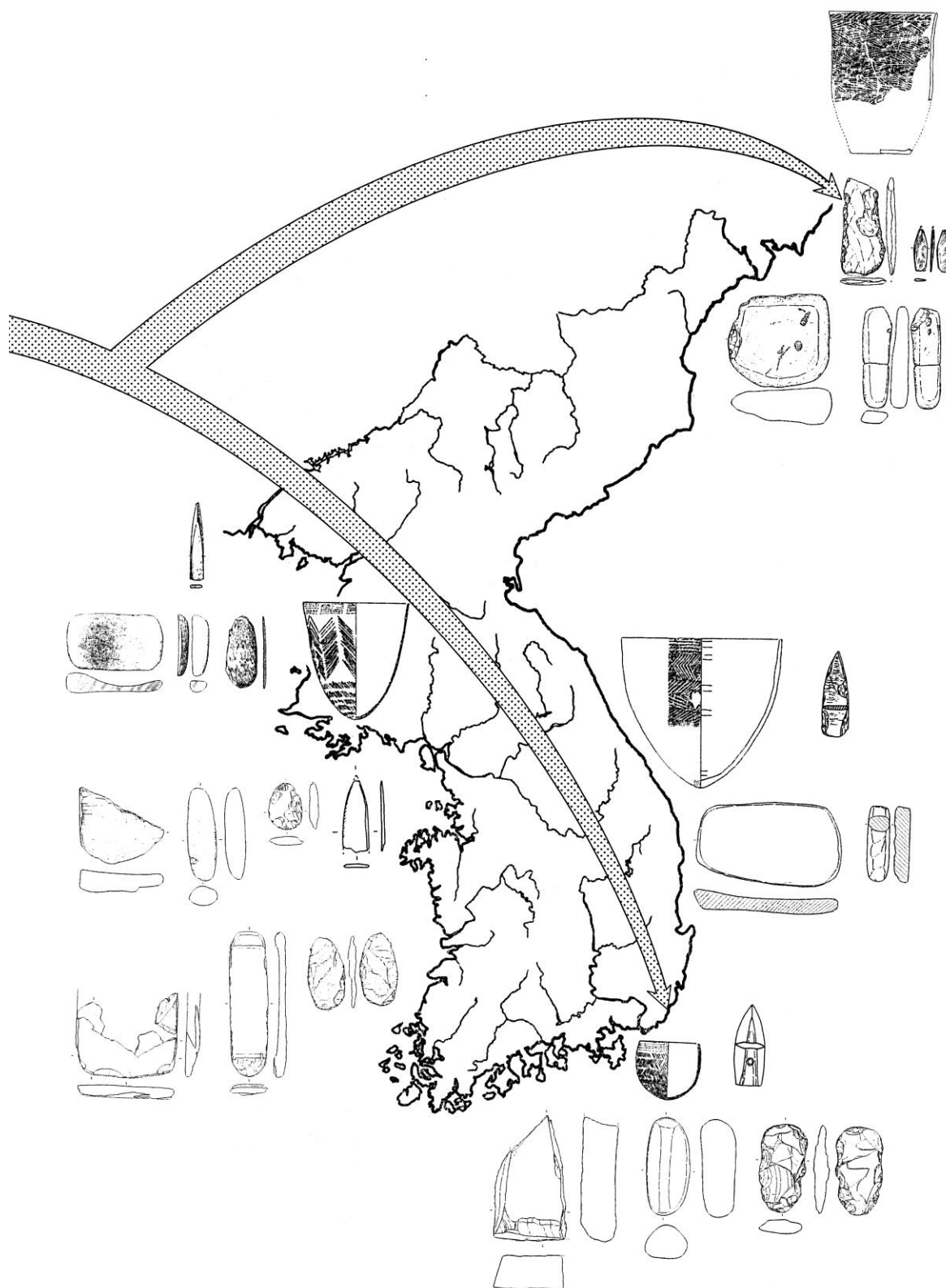


Figure 1. Spread of early millet agriculture.

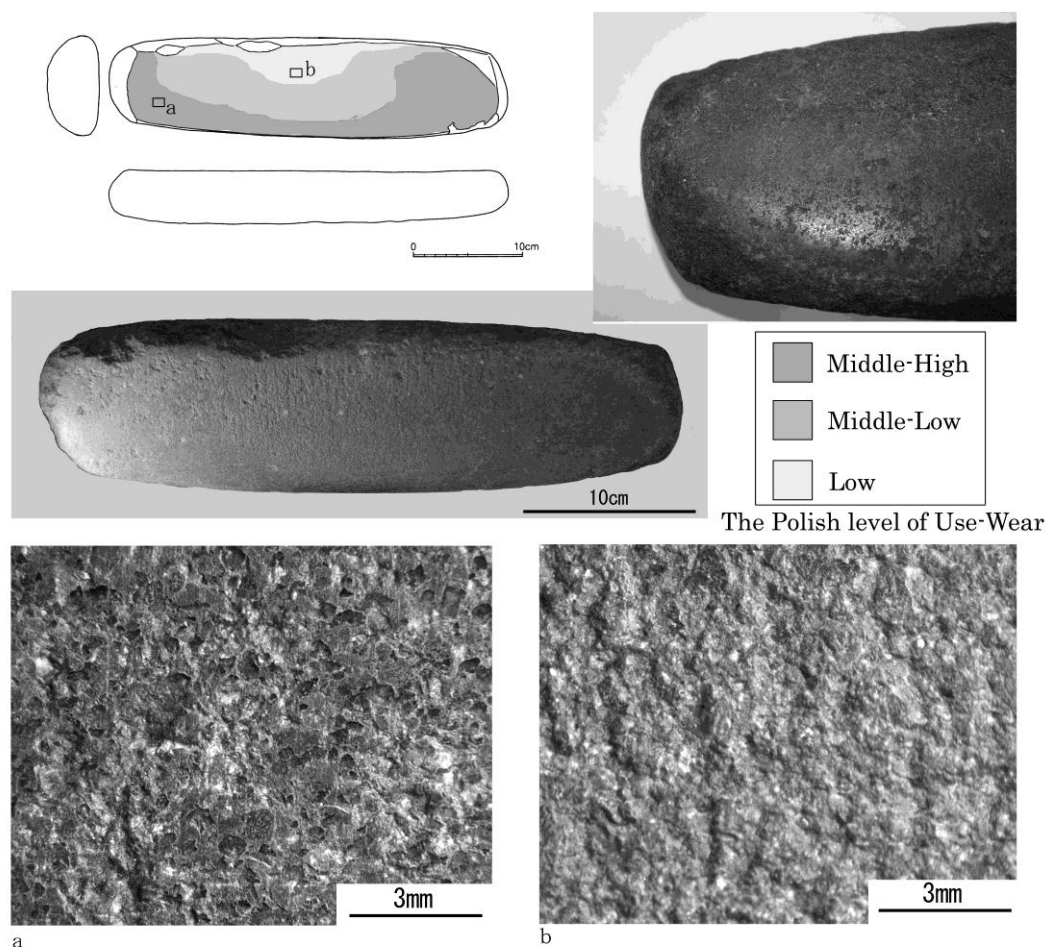


Figure 2. Use-wear marks on a stone pestle at the Chigyonli site, Kwangwondo, Korea.

The subsistence economy of Early Neolithic people in the northwestern Korean Peninsula did not strictly depend on cultigens, as can be seen from the data from the Chitamni and Masan sites, dating ca. 4000 BC. Almost all subsistence activities consisted of hunting and gathering, and millet was probably a supplemental food. In this case we should not call them farmers. Therefore, the people living there were practicing what Smith (2001) calls “low-level food production.” They would have been foragers who were acculturated to the Neolithic Chinese agriculture system, which existed in the Liaodong or Liaoxi districts of Northeast China adjacent to the northwestern Korean Peninsula (Crawford 1992). Following this, at the beginning of the Korean Middle Neolithic ca. 3400–3300 BC, millet agriculture

spread from the northwestern to the southern and eastern Korean Peninsula along with *Jeulmun* style pottery and northern Chinese style agricultural stone tools (Figure 1). This is the first stage in the spread of early agriculture in Northeast Asia. This spread process was accompanied not only by domesticated millet grains but also by cultural materials such as *Jeulmun* style pottery and northern Chinese style agricultural stone tools, etc. This means that foragers with millet agriculture in Northeast Asia could gradually move from north to south in the Korean Peninsula and gain access to lands on which they could cultivate millet. However, although the subsistence economy in the southern Korean Peninsula saw the introduction of incipient millet agriculture, it did not strictly depend on cultigens. Rather, this was a

system based in low-level food production (Smith 2001).

The Korean case provides one of the processes of the first stage of the spread of early agriculture in Northeast Asia. The second case comes from the southern Russian Far East.

The Spread of Millet Agriculture to the Russian Far East

During the first stage in Northeast Asia, in addition to their spread into the southern Korean Peninsula, domesticated grains also diffused into the southern part of the Russian Far East. In the past, the earliest archaeological evidence of agriculture in this region had been a grain of broomcorn millet at the Kirov site, dating to the latter half of the second millennium BC. However, the Final Neolithic period at the Novoselische 4 site, dated 2477–2130 cal BC is recently thought to have the earliest evidence for the emergence of cultivation in the southern Russian Far East with remains of carbonized millet grains (Kluev et al. 2002).

The application of flotation over the last decade is producing new evidence for plant domestication in this area, such as have been reported from the Rettihovka-Geologicheskaya, Sheklyaevo 7, and Zaisanovka 1 sites. Many grains of broomcorn millet and foxtail millet were discovered in pit houses of the Zaisanovka Culture at the Rettihovka-Geologicheskaya site (Sergusheva 2006). Radiocarbon dates on charcoal from pit house No. 4 are 1662–1450 cal BC, 1783–1596 cal BC, and 1693–1493 cal BC and correspond to the Final Neolithic period, ca. 1600 cal BC. Broomcorn millet grains were also found at the Sheklyaevo 7 site belonging to the Zaisanovka Culture (Sergusheva 2006). Unfortunately, the dating of the grains within the Zaisanovka Culture period is unknown. At the Zaisanovka 1 site, dating ca. 2469 cal BC, grains of barnyard grass were recovered from a pit house (Sergusheva 2006). It is unknown whether they are domesticated or not. More research is required to determine whether barnyard millet in this region was cultivated or collected from wild stands. Archaeological proof from the Rettihovka-Geologicheskaya site, however, allows us to now say that millet agriculture existed in the southern Russian Far East at least

since the Final Neolithic age.

A Japanese-Russian team directed by Masayuki Komoto and Yuri Vostretsov collected extensive data using flotation at the Krounovka 1 and Zaisanovka 7 sites (Komoto and Obata 2004; 2005). The Krounovka 1 site consists of three cultural layers. One is early Iron Age, while two are Neolithic. No cultigens were recovered from the oldest Neolithic occupation, belonging to the Voisman Culture. In the younger Neolithic occupation (Early Zaisanovka Culture), there are two pit houses, No. 4 and No. 5. AMS dates of wood charcoal from the hearth in pit house No. 4 range 3520–3350 cal BC. Broomcorn and foxtail millets have been recovered from both pit houses (Sergusheva 2007; Table 2). 16 seeds of broomcorn millet were found in pit house No. 5, and 11 seeds of broomcorn millet and a seed of foxtail millet were found in pit house No. 4. These are the oldest millets so far found in the region. Apparently agriculture was introduced sometime between the earlier and later Neolithic layers, estimated to be as early as ca. 3400 cal BC. More details about the flotation sampling, quantities, etc., are needed.

How important were these cereals to the inhabitants of the site? While the two pit houses did yield some millet grains, the largest portion of plant remains were nuts, such as walnut and hazelnut (Table 3). Subsistence activities appear to have relied on the gathering of wild plants, while millet played only a minor dietary role. Indeed, these Neolithic pit dwellings had no agricultural stone tools. The stone tools are limited only to hunting tools, such as arrowheads and scrapers. A stone mortar was found in a storage pit in pit house No. 5, but this stone mortar is unlike those from North China, and there are no stone pestles found at this site (Komoto and Obata et al. 2004). The front side of the stone mortar is not flat, but it has a round hole at the center. The linear traces from usage on the stone mortar are not in a fixed direction of movement as is seen on those of the northern Chinese Neolithic. Instead, these traces resemble Jōmon 縄文 mortars from Japan. The mortar was possibly used for grinding wild nuts, as has been suggested for Jōmon mortars (Kamijo 2005b). These people were, as in the Korean situation, low-level food producers (Smith 2001).

Table 3. Seeds found at the Krounovka 1 site and the Zaisanovka 7 site in the Russian Far East.

	Lower Neolithic layer		Upper Neolithic layer			
	Southern area		Pit dwelling No. 5		Pit dwelling No. 4	
Amount of analyzed materials	41		129		67	
Plant name	Number	Percentage	Number	Percentage	Number	Percentage
Broomcorn millet	-	-	16 (5?)	3.55%	11	2.10%
<i>Panicum milaceum</i>						
Foxtail millet (?)	-	-	-	-	1 (?)	-
<i>cf. Setalia italica(?)</i>						
Uncertain millet			8	1.77%	5	9.50%
Banyard grass	-	-	1	2.22%	1	1.90%
<i>Echinochloa crus-galli</i>						
Uncertain wild millet	-	-	3	0.66%	1	0.19%
Shiso/egoma	-	-	43	9.55%	-	-
<i>Pellila frutescens</i>						
Walnut	24 (1?)	60.0%	179	39.70%	453	86.70%
<i>Juglans mandchurica</i>						
Hazelnut	1	2.5%	160	35.50%	23	44.00%
<i>Corylus sp.</i>						
Acorn	-	-	1(3?)	2.22%	2	0.38%
<i>Quercus sp.</i>						
Amur cork-tree	10	25.0%	-	-	1	0.19%
<i>Phellodendron amurense</i>						
<i>Vitis amurensis</i>	-	-	-	-	1	0.19%
<i>Chenopodium sp.</i>	-	-	6	1.33%	2	0.38%
<i>Amarantus sp.</i>	-	-	-	-	2	0.38%
<i>Polygonum sp.</i>	1	2.5%	-	-	3	0.57%
Uncertain grains	3	7.5%	33	7.33%	17	3.25%
Uncertain nut	1	2.5%	-	-	-	-
Total amount	40 (+1?)	100%	450 (+8?)	100%	522 (+1?)	100%

Pit houses No. 4 and No. 5 of the Krounovka 1 site correspond to the early Zaisanovka period. Pottery of this period is composed of cord-marked pottery and incised pottery. This pottery is different from that of the Voisman Culture, particularly the incised design pottery that is found stratigraphically beneath these pit

houses at the Krounovka 1 site. The design of the cord-marked and incised pottery from pit house No. 5 is formed of horizontal sections filled with diagonal lines and hatching lines that are separated by parallel lines (Figure 3: Khanxi 1 type). On the other hand, the design of the cord-marked and incised pottery from pit

house No. 4 (Figure 3: Krounovka 1 type) has no regularized horizontal sections and is only composed of diagonal lines or fish bone designs. I here am calling the pottery type of pit house No. 5 the Khanxi 1 type and the pottery type from pit house No. 4 the Krounovka 1 type by the representative sites' names. Based on design regulation in typology, while the design of the pottery decoration from pit house No. 5 (Khanxi 1 type) is more complex, it nevertheless appears to have evolved out of the design of the pottery from pit house No. 4 (Krounovka 1 type). Therefore we can suppose that pit house No. 5 is older than pit house No. 4 because of the pottery typology. The distribution of pottery types from a profile with pit houses No. 5 and No. 4 indicates that the pottery type from pit house No. 5 (Khanxi 1 type) is deposited lower than that of the pottery type from pit house No. 4 (Krounovka 1 type). This evidence also indicates that pit house No. 5 type pottery is older than the later type pottery. Therefore, the early Zaisanovka period can be further subdivided chronologically by pottery types (Figure 3).

One issue is that Zaisanovka style pottery is different from the Voisman style pottery that stratigraphically comes previous to the Zaisanovka Culture period, and the Zaisanovka style pottery could not have developed out of this Voisman Culture pottery. Khanxi 1 type cord-marked pottery from the earliest Zaisanovka Culture is similar to that from the Yabuli 亚布力 site located in the inland area of the Mudanjiang 牡丹江 River valley, Heilongjiang Province, China (Heilongjiang sheng wen wu kao gu yan jiu suo 1988). The Yabuli site cord-marked pottery is typologically older than that of the Khanxi 1 type. The Yabuli site pottery can be divided into three types. The first is the cord-marked and incised pottery similar to Khanxi 1 type pottery (Figure 4: 3–5). The second type is a design with impressions from a comb-like tool (Figure 4: 6–8), and the third type is a mixed design with cord-marking and impressed designs from a comb-like tool (Figure 4: 1, 2). The first type, composed of hatching lines that are separated with parallel lines, is the same design as that of the Khanxi 1 type. The second type of design is seen in the later Voisman pottery. Pottery from the third type is

very similar to that of the latest Voisman pottery. These three types indicate that the Yaburi site corresponds to the final Voisman Culture period and that the pottery of the Yaburi site is older than that of the earliest Zaisanovka Culture. Therefore we believe that cord-marked pottery of the earliest Zaisanovka Culture spread from the inland area of the Mudanjiang River and the Suifen 绥芬 River valley. These inland foragers acculturated with northern Chinese agriculture then migrated to the coastal area. The dating of the migration of the cord-marked pottery culture from inland to the coastal area of the Russian Far East is indicated by the Krounovka 1 site, dating to 3480 cal BC. The dating of this phase thus corresponds with the dating of the spread of millet agriculture to the southern Korean Peninsula. Furthermore, this phase witnessed a cooler climate. It seems that this was the first phase of early agriculture in Northeast Asia.

The Zaisanovka 7 site belongs to the Middle phase of the Zaisanovka Culture, and is younger than the Krounovka 1 site. Pottery recovered from the Zaisanovka 7 site has mainly incised decorations (Figure 3), although some is cord-marked. Pottery designs mainly consist of fish bone designs. The units of the fish bone designs at this site are longer and coarser than those of Krounovka 1 type pottery, so the typology of the pottery also would indicate that the Zaisanovka 7 site is later than Zaisanovka 1. One AMS date from a carbonized walnut from the fourth layer of the site is 3210 cal BC, and other samples share approximately the same date. The AMS date of this site also supports the relative chronology between the Zaisanovka 1 site and the Zaisanovka 7 site.

At the Zaisanovka 7 site, walnuts and acorns predominate, as at the Krounovka 7 site. While flotation did not recover any evidence of cultigens, several grain impressions have been identified on the bases of pottery (Figure 5). While Sergusheva (2006) identifies these as broomcorn millet, Obata (2007) thinks the impressions were produced by foxtail millet. This archeological evidence means that there was millet agriculture at the Krounovka 7 site. In spite of the lack of preserved cultigens, food production was probably important in the Middle Zaisanovka Culture. The tool assemblage includes a large

number of northern Chinese style hoes, pestles, and mortars (Komoto et al. 2005) (Figure 6), none of which were found in the Early Zaisanovka Culture (i.e., the Krounovka 1 site). Use-wear evidence on the pestles and mortars indicates a fixed direction of motion consistent with flour production or de-husking millet grains (Kamijo 2005). Hoes recovered from the site are square (Figure 7: 1) and T-shaped types

(Figure 7: 2). Use-wear patterns on the square type show a fixed direction of motion along the long axis indicating that they were used for digging. The T-shaped hoes have use-wear patterns that are different on the front and back; the use-wear marks on the blades are angled (Kamijo 2005a). This indicates that the T-shaped hoes were used for furrowing and for harvesting grasses.

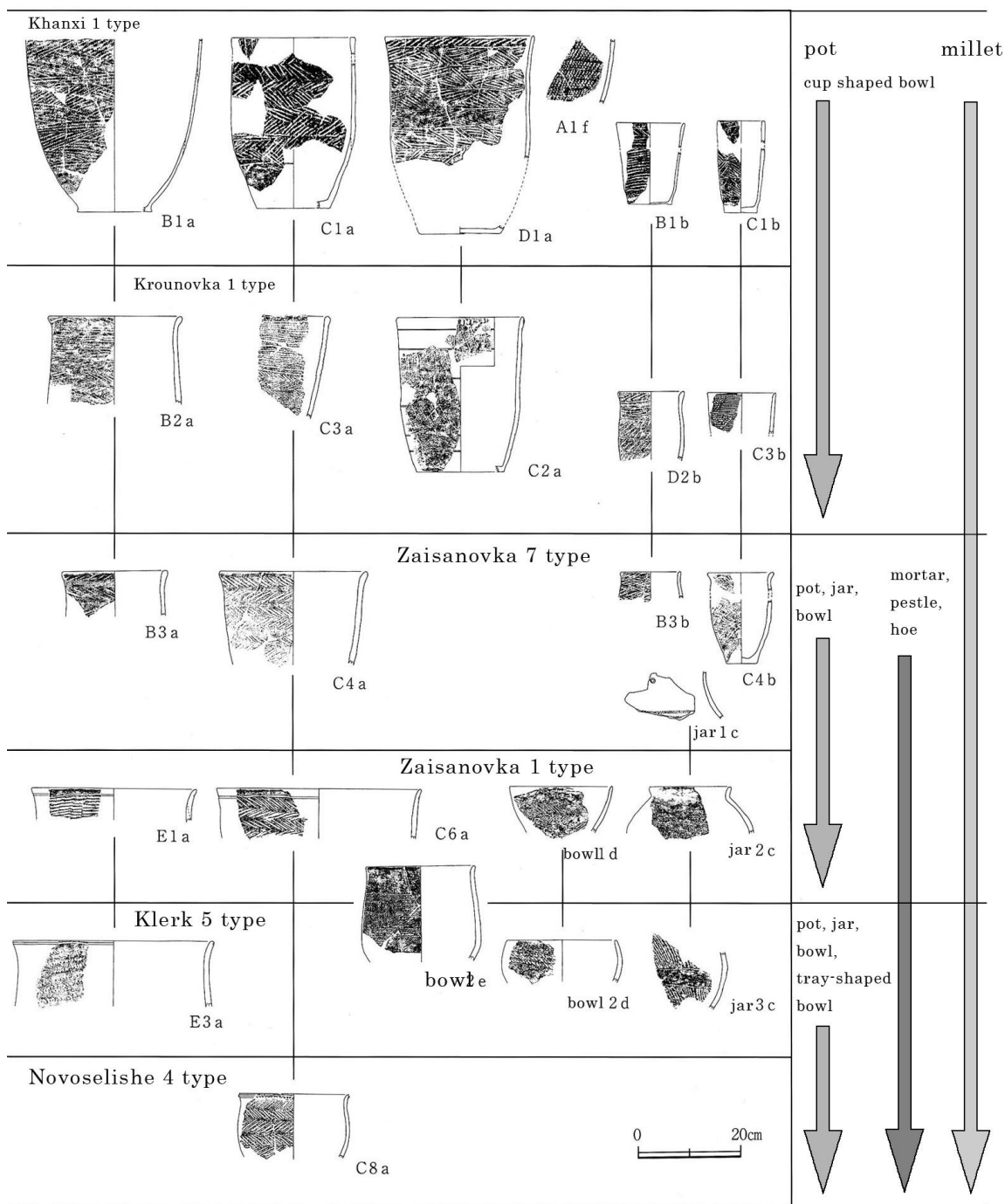


Figure 3. Pottery chronology and the process of cultural change of the Zaisanovka Culture.

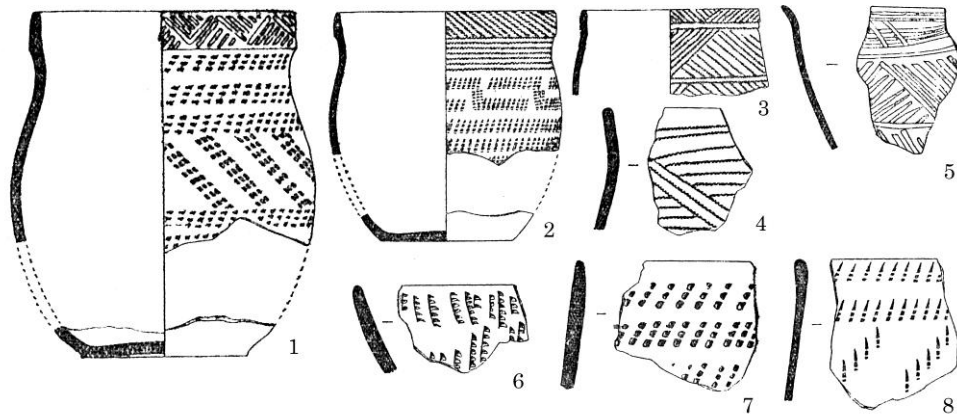


Figure 4. Pottery found at the Yabuli site in Heilongjiang Province, China.

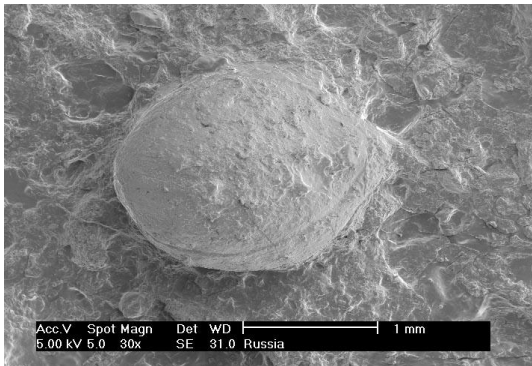


Figure 5. A grain impression found on the bottom of pottery from the Zaisanovka 7 site by replication SEM analysis.

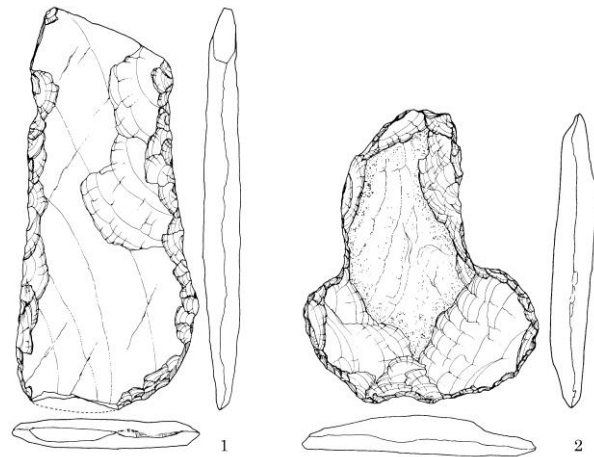


Figure 7. Stone hoes found at the Zaisanovka 7 site in the Russian Far East.

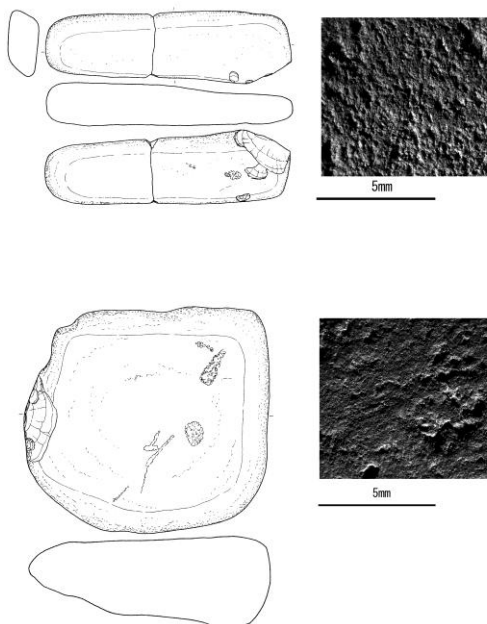


Figure 6. A stone mortar and a stone pestle found at the Zaisanovka 7 site in the Russian Far East.

Finally, Sergusheva (2006) measured the broomcorn millet grains from several sites in the Neolithic period of the southern Russian Far East (Table 4). The earliest grains of pit house No. 5 in the Krounovka 1 site are the smallest on average. The average size of grains recovered from pit house No. 4, which is younger than pit house No. 5 based on pottery chronology, is larger than those from pit house No. 5. The average length is 1.39 mm and the average width is 1.36 mm for broomcorn millet from pit house No. 5, while the average length is 1.56 mm and the average width is 1.51 mm for broomcorn millet from pit house No. 4 (Table 3). Figure 8 is a size distribution map of broomcorn millet in the Neolithic of the southern Russian Far East, with clusters into several groups (Sergusheva 2006). Broomcorn millet

from the Rettihovka-Geologicheskaya site (Late Zaisanovka culture) is divided into two groups by size, but both groups are larger than those from the Krounovka 1 site (Figure 8). The earliest broomcorn millet at the Xinglonggou 兴隆沟 site in Liaoning Province, China, by comparison, is even smaller in size. Grain size of

cereals is supposed to gradually increase with the change from wild to domesticated. This evidence of development in the grain size of broomcorn millet according to the period indicates the local evolution of broomcorn millet agriculture.

Table 4. Comparison of broomcorn millet between dwelling pit No. 4 and No. 5 at the Korounovka 1 site.

Sample number	Length(mm)	Width(mm)	Depth(mm)	Length/width	Depth/width	Location of collection
Dwelling pit No. 4						
1	1.6	1.6	1.2	100	75	Hearth
2	-	-	-	-	-	Hearth
3	1.6	1.6	1.2	100	62.5	Д-10, hearth
4	1.7	1.5	1.1	113.3	73.3	Д-10, hearth
5	1.5	-	0.9	-	-	Д-10, hearth
6	1.5	1.5	1.15	100	76.6	Д-9, lower layer of pit dwelling
7	1.4	-	-	-	-	Е-10, lower layer of pit dwelling
8	>1.5	-	>1.3	-	-	Д-9, lower layer of pit dwelling
9	1.6	1.5	1.3	106	81.25	Д-9, lower layer of pit dwelling
10	1.6	1.4	1.4	114.28	100	Г-11, lower layer of pit dwelling
Average	1.56	1.51	1.17	105.59	78.1	
Dwelling pit No. 5						
1	1.3	1.4	1.0	92.85	71.42	Е-5, hearth
2	1.2	1.2	0.95	100	78.16	Е-5 区, hearth
3	Fragment			-	-	Е-5, hearth
4	Fragment			-	-	Е-5, hearth
5	1.6	1.4	-	114.28		Е-5, hearth
6	-	1.55	-	-	-	Д-3, on the floor of dwelling
7	1.45	1.3	1.1	115.38	84.61	Д-3, lower layer of pit dwelling
8	1.5	1.4	1.2	107.14	85.71	Ж-5, lower layer of pit dwelling
9	1.3	1.3	1.15	100	88.46	Ж-5, lower layer of pit dwelling
Average	1.39	1.36	1.08	104.94	81.87	

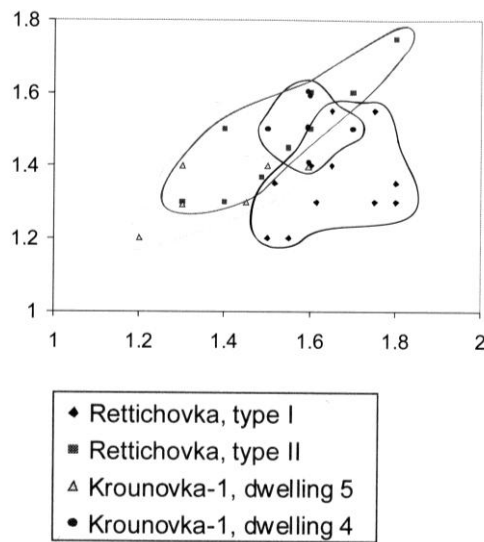


Figure 8. The development of grain size of broomcorn millet in the Russian Far East.

Discussion

The beginning of agriculture in the southern Korean Peninsula and the southern Russian Far East have significant parallels. These developments were almost simultaneous in the southern and eastern Korean Peninsula (Figure 1) and the southern Russian Far East. The first food production in these regions involved the same crops, foxtail and broomcorn millet, but these crops seem to have played only a minor subsistence role; the people in these regions were low-level food producers. Pottery styles changed with the introduction of these crops. Pottery styles of the southern and coastal areas of the Korean Peninsula were different from those of the northwestern Korean Peninsula before ca. 3300 BC. Subsequently, the pottery styles in these areas became similar to those of the northwestern Korean Peninsula. This pottery type is known as *Jeulmun*, and the appearance of this pottery type marks the beginning of the Middle Neolithic in the peninsula (Miyamoto 1985). In the Russian Far East, cord-marked pottery appears during the Early Zaisanovka Culture. This pottery style is not part of the earlier Voisman assemblage. The Early Zaisanovka Culture cord-marked pottery consisted of the Khanxi 1 and Krounovka 1 types (Miyamoto 2004). The Voisman Culture pottery consisted of the engraved design pottery, which was autonomously invented in this

area. I think that the Voisman Culture could not have invented the cord-marked pottery of the Early Zaisanovka Culture since the pottery types are so distinctive. The distribution of cord-marked pottery is recognized not only in the coastal area of the southern Russian Far East but also in the inland area near Lake Khanka. For example, the Yabuli site in Heilongjiang Province of China, which is located in the upper valley of the Mudanjiang River, has yielded cord-marked pottery. I believe the cord-marked pottery originated in this region and spread into the southern Russian Far East at the beginning of the Early Zaisanovka Culture.

In addition to the appearance of cord marked pottery, the Krounovka 1 site yielded willow-leaf type polished arrowheads as well as chipped arrowheads. The Voisman Culture of the southern Russian Far East had no polished arrowheads, only chipped arrowheads and other chipped artifacts. The willow-leaf, polished arrowheads are a later development. On the other hand, the Yabuli site yielded willow-leaf polished arrowheads. This situation parallels the southern and eastern coast of the Korean Peninsula. The willow-leaf, polished arrowheads appear along with the new style of pottery. The new pottery types and willow-leaf, polished arrowheads also seem to have spread with the northern Chinese style agricultural stone tools.

How and why did agriculture begin in these regions? It is important to recognize that there were similar diffusion processes including not only crops but also agriculture-related artifacts and other artifacts simultaneously in two regions in Northeast Asia. The timing of the spread of millet agriculture to the southern coast of the Korean Peninsula and to the southern Russian Far East corresponds to a period of cooler climate (Figure 9). Cores obtained from Lake Suigetsu 水月 and Lake Tōgō 東郷 in Japan show a climatic deterioration ca. 3300–3500 BC (Fukusawa 1995; Kato, Fukusawa, and Yasuda 2003). The impact of cooler weather conditions is also recognized at sites. For example, a sandy soil layer can be found at the coastal sites that was composed by wind during cooler weather (Komoto 2008). There is a thick sandy layer between a layer containing Sōbata 曾畑 type pottery of the Early Jōmon and the

beginning of Middle Jōmon layer at the Ōya 大矢 site, Kumamoto 熊本 Prefecture, Kyūshū Island, Japan. An acorn found in an acorn storage pit with Sōbata type pottery at the Ireibaru C 伊礼原 site in Kyūshū was radiocarbon dated to 3480–3370 cal BC. And carbon on Kasuga 春日 type pottery of the earlier Middle Jōmon of Kyūshū Island was dated to 3090 cal BC. So we can imagine that the dating of cooler weather conditions on Kyūshū Island must be about 3300–3200 BC. Because of this evidence from cores and the dating of the deposition of the sandy layer at the coastal sites, we can say that this cooler weather condition existed during the latter half of the fourth millennium BC in Northeast Asia.

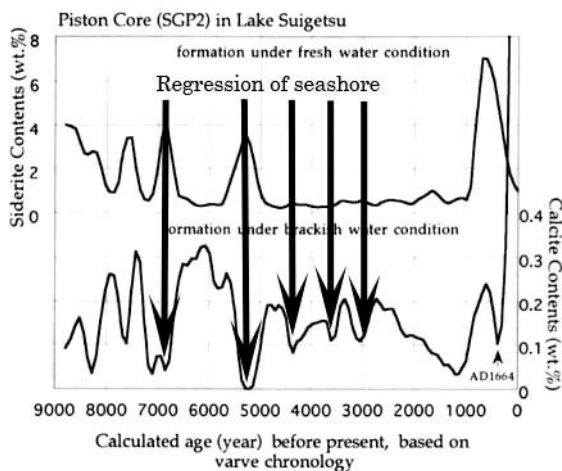


Figure 9. Regression of the seashore based on the analysis of a piston core from Lake Suigetsu.

In the northwestern Korean Peninsula, the cooler weather during this time period affected the acculturated foragers, who were influenced by the farming cultures of the Liaodong region of Northeast China and were practicing millet agriculture. This climatic change caused population pressure due to shortage of foods, which in turn caused migration of a portion of the people to the southern and eastern coasts of the Korean Peninsula. At the same time, some of the acculturated foragers with early millet agriculture who were producers of the Yabuli pottery type in the upper valley of the Mudanjiang River migrated to the southern coast of the Russian Far East through the inland area of the Suifen River valley, bringing the foundation of the Early Zaisanovka Culture with them. The

spread of early agriculture into this region was also caused by a small population of immigrants who moved there due to the cooler weather conditions.

The *Jeulmun* pottery style and willow-leaf, polished arrowheads seem to have spread with cultigens and the northern Chinese style agricultural stone tools: these stone tools—the stone mortar, stone pestle, and stone hoe—spread a little later into the southern Russian Far East (Figure 3). This situation is very similar to the spread of domesticated millet to the southern coast area of the Korean Peninsula, accompanied by the *Jeulmun* pottery style, northern Chinese style agricultural stone tools, and the willow-leaf form of polished stone arrowheads (Figure 1). In addition, the timing of the spread was almost the same for both the southern Korean Peninsula and the southern Russian Far East. The AMS dates from pit house No. 4 at the Krounovka 1 site of the Early Zaisanovka Culture are between 3520 and 3350 cal BC. The AMS date of foxtail millet from pit house No. 1 at the Dongsamdong 東三洞 shell midden, in Pusan 釜山, South Korea is 3360 cal BC, roughly the beginning of the Middle Neolithic in the Korean Peninsula. This period is characterized by the spread of the *Jeulmun* pottery style, the willow-leaf arrowhead, and northern Chinese style agricultural stone tools from the northwest Korean Peninsula. I believe that at about this time, the early agriculturists or some of the acculturated foragers spread to hunting-gathering regions in the southern coast of the Korean Peninsula and in the southern Russian Far East. It is important to recognize that there were similar diffusion processes including agriculture-related artifacts appearing simultaneously in these two regions of Northeast Asia.

The occurrence of domesticated millet and northern Chinese style agricultural stone tools accompanied by the spread of new pottery styles are indicative of small amounts of millet agriculture being introduced to supplement the hunting-gathering economies of the southern coast of the Korean Peninsula and the southern Russian Far East. This situation should be called the first stage of the spread of early agriculture into these parts of Northeast Asia, and these are cases of secondary agricultural societies.

Conclusion

Low-level food production began to appear in the fourth millennium BC in Northeast Asia. While incipient millet production started in the Early Zaisanovka Culture ca. 3400 cal BC in the southern Russian Far East, subsistence activities there still depended largely upon the gathering of wild plants such as nuts, as is indicated by the flotation results from the excavations at the Krounovka 1 and Zaisanovka 7 sites. This situation is similar to developments along the southern coast and the eastern coast of the Korean Peninsula. Subsistence activities there, as well, emphasized hunting and gathering, with millet production being supplemental.

In summary:

(1) The emergence of millet agriculture in the Russian Far East and the southern coast area of the Korean Peninsula not only have similar dates of ca. 3400 cal BC, but is also accompanied by a change in pottery styles and the introduction of northern Chinese style agricultural stone tools;

(2) The spread of millet agriculture to the southern Russian Far East from the inland area of upper Mudanjiang River valley and to the southern and eastern coast areas from the northwest Korean Peninsula at about 3400 cal BC was the first stage of early agriculture in Northeast Asia, and this spread may have been caused by climatic cooling; and

(3) Foragers who were acculturated by northern Chinese agriculture in the northwestern Korean Peninsula and in the inland Russian Far East area migrated respectively to the southern Korea Peninsula and to the coastal area of the southern Russian Far East, bringing millet with them.

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