

The beginnings of prehistoric agriculture in the Russian Far East: current evidence and concepts

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ABSTRACT – *The current situation with studies of prehistoric plant cultivation in the Russian Far East is presented. A critical analysis of existing concepts and models of the oldest agriculture in this region is also included. Reliable data allows us to conclude that humans in the southern Russian Far East (Primorye Province) began to cultivate millet at c. 4700–4600 BP (c. 3600–3400 calBC) in the context of the early Zaisanovka cultural complex of the Late Neolithic. The most probable source area for prehistoric agriculture in the Russian Far East was neighbouring Northeast China (Manchuria).*

IZVLEČEK – *V članku predstavljam trenutno stanje raziskav prazgodovinske kulture rastlin na ruskem Daljnem vzhodu. Vključena je tudi kritična analiza obstoječih konceptov in modelov o najstarejšem poljedelstvu na tem območju. Zanesljivi podatki kažejo, da so ljudje v južnem delu ruskega Daljnega vzhoda (provinca Primorye) pričeli gojiti proso ok. 4700–4600 BP (ok. 3600–3400 calBC) v kontekstu zgodnjega kulturnega kompleksa Zaisanovka v poznem neolitiku. Najverjetnejše izvorno območje prazgodovinskega ruskega poljedelstva na Daljnem vzhodu je sosednja severna Kitajska (Mančurija).*

KEY WORDS – *Russian Far East; Late Neolithic; Zaisanovka culture; prehistoric agriculture; millet*

Introduction

In original geographical sources, the Russian Far East refers primarily to Primorye (Maritime) Province, the Amur River basin, Sakhalin Island, and the Kurile Islands (*Suslov 1961; Ivanov 2002*). In this paper, a review of the current state of knowledge of the earliest (*i.e.* prehistoric) agriculture in this part of Northeast Asia is presented, with a discussion of existing concepts and models on the emergence of plant cultivation. Updated summaries of Stone Age (both Palaeolithic and Neolithic) archaeology and chronology in the Russian Far East can be found in volumes edited by Zhanna V. Andreeva (*2005*) and Sarah M. Nelson *et al.* (*2006*), and in an overview paper by Yaroslav V. Kuzmin (*2012a*). The current progress in archaeobotanical studies of agriculture in continental East Asia is given by Gary W. Crawford (*2006*), Harriet V. Hunt *et al.* (*2008*), Zhi-jun Zhao (*2011*), and Gyoung-Ah Lee (*2011*).

Materials and Methods

At present, traces of early agriculture (in the form of cultivated cereals) in the Russian Far East are known from about 10 sites (Fig. 1; Tab. 1). All except one (*i.e.* Valentin-Peresheek) are in the southern part of Primorye Province, mainly in the forest steppe biome (*Kuzmin 2006a.14–15*) and also on the coast of the Sea of Japan.

In Russian archaeological practice, so-called ‘archaeological cultures’ (to some extent similar to ‘cultural complexes’ in Western archaeology) are usually defined (*e.g., Trigger 2006.343*). Each culture or cultural stage, significant in terms of early agriculture, is briefly characterised here. It is also important to remember that in Russian archaeology, the Palaeolithic and Neolithic are separated on the basis of presence of pottery rather than agriculture (*e.g., Kuzmin 2006a; 2010a*).

In the Neolithic of Primorye, the three main archaeological cultures are: Rudnaya [Rudnaia], Boisman, and Zaisanovka [Zaisanovsky] (e.g., *Zhushchikhovskaya 2005; 2006*). In the Rudnaya and Boisman complexes of the Early-Middle Neolithic, hunting, fishing, and gathering of terrestrial and marine organisms formed the basis of the economy (e.g., *Kuzmin 1995; 1997a; 2006b*). The Zaisanovka culture of the Late Neolithic has the earliest manifestations of agriculture, along with non-productive economic activities. Research indicates that the Zaisanovka complex dates to c. 5800–3100 BP (c. 4800–1500 calBC) (*Kuzmin 2002; 2006a; Kuzmin et al. 1994; 1998a; 1998b*). Pottery analysis defines two chronological stages of the Zaisanovka complex: (1) an early stage, with located mainly on the coast of the Sea of Japan (including the Zaisanovka 7 site) and a few inland sites (the early component of the Krounovka 1 site; see below), dated to the 4th millennium BC; and (2) a late stage, with sites situated mainly on the Khanka Plain (including Novoselishche 4 and Rettikhovka-Geologicheskaya sites) and in the coastal zone (Zaisanovka 1 and Gvozdevo 4 sites), dated to the 3rd–2nd millennia BC (*Yanshina, Klyuev 2005.200*).

The concept of ‘economic-cultural type’ (hereafter ECT) is used in Russian ethnographical and archaeological research to characterise major branches of palaeoeconomy: “[that] groups together historically established cultural and economic characteristics of different people who are at the same level of socioeconomic development and live under similar natural conditions” (*Cheboksarov 1981*). The main ECT of the Neolithic populations in the southern Russian Far East has been enumerated by Kuzmin (2005. 186–187; 2012b) (see Fig. 2). In the Early-Middle Neolithic, several ECTs existed in the Russian Far East: (1) forest hunters and fishers of the Sikhote-Alin Mountains and Zeya River basin; (2) fishers and hunters of the Amur River basin; and (3) coastal hunters, fishers, and marine mollusc gatherers of Primorye (e.g., *Kuzmin, Rakov 2011; Fig. 2.1–3*). In Manchuria, the ECT of early horticulture based on millet cultivation emerged (Fig. 2.4). In the Late Neolithic, this ECT spread to Primorye and the Korean Peninsula (see Fig. 2); at the same time, the role of hunting, fishing, and gathering remained important, and the above-mentioned ECTs continued to co-exist in Primorye along with the new ECT of food producers.

For the purpose of this review, both direct and indirect data related to plant cultivation are used. The direct indicators are the finds of cultigens’ seeds. As

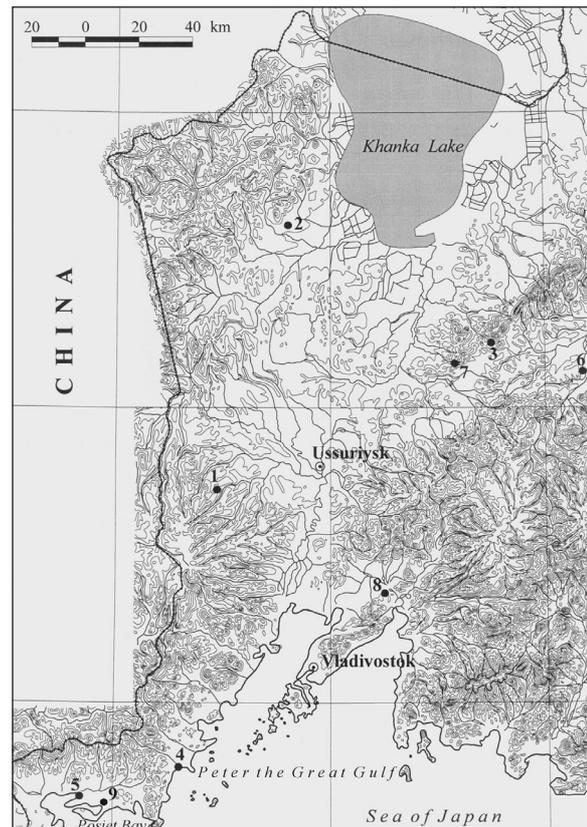


Fig. 1. The earliest sites with evidence of agriculture in Primorye Province: 1 Krounovka 1; 2 Novoselishche 4; 3 Rettikhovka-Geologicheskaya; 4 Boisman 2; 5 Zaisanovka 1, 2, and 7; 6 Sheklyaevo 7; 7 Mustang 1 and Bogolubovka 1; 8 Kirovsky; 9 Gvozdevo 4.

for indirect traces of agriculture, two kinds can be distinguished:

- ① archaeological evidence in the form of tools which might have been used in agricultural practices, such as hoes, ripping knives, and grind stones (querns);
- ② palynological indicators such as pollen of cultivated cereals.

The study of plant remains at prehistoric sites in Primorye, recovered from cultural layers by means of water flotation, was conducted according to international standards (e.g., *Harstorf, Archer 2008; Pearsall 2000*).

The radiocarbon dating of sites with evidence of early agriculture in Primorye was undertaken according to general practice in this field (e.g., *Taylor 1987; Jull 2007; Cook, van der Plicht 2007*). Critical analysis of the results obtained is a crucial part of age determination; the main principal is ‘chronometric hygiene’ (*sensu Spriggs 1989; see also Kuzmin 2006c*).

Site, layer	Material dated	¹⁴ C date, BP	Lab No.	Calendar age, calBC*	References
<i>Primary sites/components/dates</i>					
Krounovka 1, levels 2–3	Charcoal	4670 ± 30	NUTA2-5643	3620–3370	<i>Komoto, Obata 2004</i>
	Charcoal	4640 ± 40	Beta-171662	3620–3350	<i>Komoto, Obata 2004</i>
Novoselishche 4, below Stratum 7**	Charcoal	3840 ± 70	AA-13400	2480–2050	<i>Kuzmin et al. 1998b</i>
	Charcoal	3755 ± 35	AA-36748	2290–2040	<i>Kuzmin 2006a</i>
	Millet seeds	3840 ± 40	TKa-14081	2460–2150	<i>Sergusheva 2007b</i>
Rettikhovka-Geologicheskaya	Charcoal	3390 ± 55	SOAN-4239	1880–1530	<i>Kolomiets et al. 2002</i>
	Charcoal	3310 ± 45	SOAN-4240	1730–1500	<i>Kolomiets et al. 2002</i>
	Charcoal	3280 ± 45	SOAN-4238	1670–1450	<i>Kolomiets et al. 2002</i>
<i>Secondary sites/components/dates</i>					
Krounovka 1, levels 2–3***	Charcoal	4795 ± 45	NUTA2-5281	3660–3380	<i>Komoto, Obata 2004</i>
	Carbonized nut	4790 ± 40	Beta-180131	3650–3380	<i>Komoto, Obata 2004</i>
Novoselishche 4, Stratum 7 (?)	Millet seeds	3090 ± 50	SNU04-192	1490–1210	This paper
Novoselishche 4, Stratum 5	Seeds (unidentified)	3170 ± 60	SNU04-191	1610–1310	This paper
	Millet seeds	3015 ± 50	TKa-13487	1410–1120	<i>Sergusheva, Klyuev 2006</i>
Mustang	Charcoal	4660 ± 60	Ki-3151	3630–3200	<i>Kuzmin et al. 1994</i>
	Charcoal	4050 ± 70	Ki-3152	2880–2460	<i>Kuzmin et al. 1994</i>
Sheklyaevo 7	Food crust****	4435 ± 45	AA-60053	3330–2920	<i>Kuzmin 2012a</i>
	Food crust****	4430 ± 45	AA-60051	3330–2920	<i>Kuzmin 2012a</i>
	Charcoal	4390 ± 45	AA-60058	3320–2900	<i>Kuzmin 2012a</i>
Kirovsky	Charcoal	4150 ± 60	Le[RUL]-193	2980–2580	<i>Butomo 1965; Kuzmin et al. 1998b</i>
Gvozdevo 4	Food crust****	4130 ± 40	AA-60612	2870–2580	<i>Kuzmin 2012a</i>
Zaisanovka 1	Carbonized nut	4010 ± 45	NUTA2-5282	2840–2360	<i>Komoto, Obata 2004</i>
	Carbonized nut	3970 ± 30	NUTA2-5483	2570–2350	<i>Komoto, Obata 2004</i>
Bogolubovka 1	Charcoal	3890 ± 60	SNU07-260	2560–2150	<i>Garkovik 2008</i>

*Calib 6.0.1 software was used, see *Reimer et al. 2009* (± 2 sigma, all possible intervals combined and rounded to the next 10 years).
**Samples were collected from the floor of the dwelling.
***These ¹⁴C values are less securely associated with the finds of millet seeds than the ¹⁴C dates NUTA2-5643 and Beta-171662 (see text).
****These ages were obtained on food adhesions on the pottery surface, and could be older than the contemporaneous charcoal; see *Fischer, Heinemeier 2003*.

Tab. 1. Radiocarbon dates associated with the earliest millet agriculture in Primorye (from Kuzmin 2012a, modified).

For readers who may be interested in the original Russian references, the citation of Russian sources is given as Romanisation for the titles of papers and monographs and their translations into English, and with only Romanised titles of edited volumes and journals. This method of quoting sources in non-Roman languages makes it possible to search for them in the catalogues of Western libraries. The current approach follows volumes edited by Nelson *et al.* (2006), Kuzmin *et al.* (2007), and Kuzmin and Glascock (2010).

The earliest agriculture in the Russian Far East: factual data

The oldest direct evidence for agriculture is found in the Late Neolithic component of the Krounovka 1 site (Fig. 1), located in the Krounovka River valley

of southern Primorye. The site was discovered in the late 1950s (*Okladnikov 1965*), and the first excavations were conducted in the 1960s; it is a typical late Zaisanovka complex (*Brodiansky 1987,91*). The second campaign took place in the 2000s. The remains of two dwellings (Nos. 4 and 5) were found (*Komoto, Obata 2004*). Compared to the 1960s excavation, an earlier Zaisanovka component was discovered. Among the stone tools typical of Zaisanovka culture (arrowheads, scrapers, drills, and hammer-stones; see *Zhushchikhovskaya 2006.113–115*), several saddle querns and their fragments were found; these may have been used to process grain crops (*Komoto, Obata 2004*).

There are four ¹⁴C dates associated with this cultural component (see Tab. 1). The value of c. 4795 BP was obtained on a sample collected from the site

wall during the cleaning of the profile. The ^{14}C dates of *c.* 4640 BP and *c.* 4670 BP were generated on specimens from hearths in Dwelling 4. The ^{14}C value of *c.* 4790 BP was gained from carbonised acorn collected from a hearth near Dwelling 4. The ^{14}C values of *c.* 4640–4670 BP are the most securely associated with the millet seeds, and therefore provide the most reliable age estimate for the emergence of plant cultivation in the Russian Far East (see below).

Flotation of sediments from the Zaisanovka cultural layer resulted in the recovery of cultigen remains (Sergusheva 2007a, 2007b; Sergusheva, Vostretsov 2009). The cultigen seeds are all from dwellings 4 and 5, where 28 individual seeds (3.9% of total plant remains from both dwellings) of broomcorn millet (*Panicum miliaceum*), some 43 seeds (17.9% of total plants from Dwelling 5) of beefsteak plant (*Perilla frutescens*), and 2 seeds, provisionally identified as foxtail millet (*Setaria italica*), were recovered (Komoto, Obata 2004: 48–50). Seeds of unidentified wild grasses, barnyard grass (*Echinochloa crus-galli*), and several other unidentified species were also retrieved (1.3–2.7% of total plant remains) (Sergusheva 2007a, 2007b). Other wild plants include Amur cork tree (*Phellodendron amurense*), grape (*Vitis amurensis*), chenopod (*Chenopodium* sp.), amaranth (*Amarantus* sp.), and knotweed (*Polygonum* sp.). Nuts and acorns are also present: Manchurian walnut (*Juglans mandshurica*), hazel (*Corylus* sp.), and oak (*Quercus* sp.). Overall, wild plants constitute about 75–92% of the total seed assemblage.

The second site with reliable evidence of early agriculture is Novoselishche 4, situated on the Khanka Plain in the southwestern part of Primorye (Fig. 1). Excavations were conducted in the late 1980s and in the 1990s, and exposed a Late Neolithic pit house (Sergusheva, Klyuev 2006). Three cultural assemblages were identified: Late Neolithic (strata 6–7), Bronze Age (strata 3–5), and Early Iron Age (strata 1–2) (Klyuev et al. 2002). The oldest cultural layer (Stratum 7) is of primary importance. The Late Neolithic pottery here resembles that of the Zaisanovka culture with 'vertical zigzag' and meander motifs (Klyuev et al. 2002). Among the stone tools, typical of the Zaisanovka complex, semi-lunar knives, querns, and hoes are noteworthy. They may have been used to harvest and process cultivated cereals (Sergusheva, Klyuev 2006).

Two ^{14}C dates were generated from the dwelling floor of the Zaisanovka component: *c.* 3840 BP and

c. 3755 BP (Tab. 1). The sample collected from the infill of the Zaisanovka dwelling belonging to strata 6–7 (*i.e.* above the dwelling's floor) returned an age of *c.* 3045 BP (Kuzmin et al. 1998b). Thus, only material taken from the dwelling floor should be considered as corresponding to the Late Neolithic component of this site. The overlying Bronze Age component was dated to *c.* 2980 BP (Kuzmin et al. 1994).

The Novoselishche 4 site is the first one in the Russian Far East where attempts to conduct direct ^{14}C dating of cultigen seeds were made (see Tab. 1). Two AMS ^{14}C dates were run in 2004: Stratum 5 – *c.* 3170 BP; and Stratum 7 (?) (broomcorn millet seeds) – *c.* 3090 BP (Jong C. Kim, personal communication, 2004). These values are younger than the dates on charcoal from the dwelling floor, *c.* 3840–3755 BP (Tab. 1). Contamination from the overlying Bronze Age component, where millet seeds are abundant (*e.g.*, Sergusheva, Klyuev 2006), may explain the discrepancy. Another AMS ^{14}C date was obtained on broomcorn millet from Stratum 5: *c.* 3015 BP (Tab. 1). The stratigraphic association of cultivated cereals at Novoselishche 4 remained in doubt until the AMS ^{14}C date of millet from the dwelling floor resulted in a date of *c.* 3840 BP (Tab. 1). Therefore, charcoal material from the floor of a dwelling at the Novoselishche 4 is most securely associated with cultigen seeds.

Plant remains, recovered from the Late Neolithic dwelling at the Novoselishche 4 site, include seeds of broomcorn millet from the bottom of the house fill (strata 6–7) and from the floor. There are 50 individual millet caryopses (about 30% of total plant remains) (Sergusheva, Klyuev 2006). Besides domesticated millet, vetch (*Vicia* sp.), barnyard grass, sheep sorrel (*Rumex acetosella*), hazel, Amur cork tree, oak, and grapevine, were found.

The third site with direct evidence of early agriculture in the Russian Far East is Rettikhovka-Geologicheskaya on the Khanka Plain (Fig. 1). It was discovered in 1992 (Kolomiets et al. 2002), and excavated in 1999 and 2004. The cultural remains consist of two components, the Late Neolithic and Early Iron Age (Kolomiets et al. 2002; Sergusheva 2006). Stone tools and pottery were recovered from the Late Neolithic layer. Arrowheads and querns are the most numerous stone artefacts. Pottery analysis indicates that the ceramics are typical of the late Zaisanovka complex (Kolomiets et al. 2002:98–99). The capacity of some vessels is up to 30–40 litres, and for the largest container is more than 70 litres (Kolomiets et al. 2002; Sergusheva 2006); these vessels may have

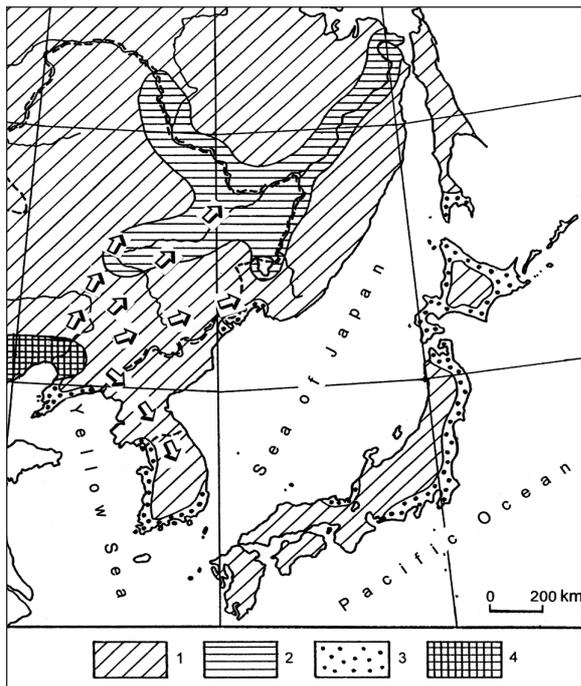


Fig. 2. Economic-cultural types (ECTs) of the Early-Middle Neolithic in Northeast Asia (before c. 5000 BP) and the diffusion of millet agriculture from a core in Northeast China (shown by arrows). The ECTs: 1 forest hunters, gatherers, and fishers; 2 sedentary fishers and hunters in large river valleys; 3 coastal fishers, gatherers, and marine mammals' hunters; 4 millet hoed horticulturalists.

been used for grain storage. Three samples from the lower part of the Late Neolithic dwelling were ^{14}C dated to c. 3390-3280 BP (Tab. 1); all of these ^{14}C values overlap with ± 2 sigma; the dates average 3330 ± 50 BP (c. 1740-1500 calBC).

Sediments from a storage building adjacent to the dwelling with ^{14}C dated charcoal were floated. Although the exact number of seeds is not reported, they are apparently numerous. Seeds of broomcorn millet and foxtail millet were recovered, constituting the majority of the plant remains (Sergusheva 2006). A few carbonised fragments of hazelnuts and walnuts were also identified.

In addition to these three sites with well-studied evidence of plant cultivation, some other Zaisanovka culture sites in Primorye yielded either single millet seeds or cereal pollen (Fig. 1) (see Lysov 1966; Verkhovskaya, Kundyshev 1993; Sergusheva 2011.88).

A small quantity of foxtail millet seeds was recovered from the Zaisanovka 1 site (Sergusheva 2007a; 2007b) on the coast of Posiet Bay (part of the Peter the Great Gulf) in southwestern Primorye (see Fig.

1). Another site in this area, Gvozdevo 4, also yielded a single seed of broomcorn millet (Sergusheva 2011). One broomcorn millet seed was found in the Zaisanovka component of the Sheklyaevo 7 site (Sergusheva 2007b) in continental southern Primorye (Fig. 1). At another site located nearby, Mustang 1, a possible foxtail millet seed was recovered; the uncertainty is related to its poor preservation (Sergusheva 2007b). Garkovik (2008) recently presented data on a find of broomcorn millet from the Bogolubovka 1 site in southern Primorye, from the Late Neolithic context of the Zaisanovka culture. The dates for these sites range from c. 4660 to 3890 BP (see Tab. 1).

At the multi-period site of Kirovsky in southern Primorye (Okladnikov, Brodiansky 1969.3-4), foxtail millet seeds are associated with a date of c. 4150 BP (Tab. 1). The millet was initially related to the Bronze Age complex (Butomo 1965.228; Okladnikov, Brodiansky 1969.4), but later appears to have been associated with the Late Neolithic component (Kuzmin et al. 1994.363; Kuzmin et al. 1998b; Yanshina, Klyuev 2005.191). The date of c. 4150 BP corresponds to the general chronology of the Zaisanovka culture (e.g., Kuzmin 2002; 2006a; 2012a).

The Late Neolithic component of the Boisman 2 site on the Peter the Great Gulf coast, associated with the Zaisanovka culture (e.g., Zhushchikhovskaya 2006.113), contains large grass pollen, which may be of cultivated species (Verkhovskaya, Kundyshev 1993). The ^{14}C date on charcoal from this component is c. 3710 BP (Kuzmin et al. 1998b). Another site located north and east of the Peter the Great Gulf area, Valentin-Peresheek, also yielded pollen of possible cultivated cereals (Kuzmin, Chernuk 1995). It was identified in the main Neolithic cultural layer belonging to the Zaisanovka culture (e.g., Zhushchikhovskaya 2006). The ^{14}C dates from this layer are c. 4900-4320 BP (e.g., Kuzmin 2006a). Pollen of possible cultivated species was also detected at the Late Neolithic component of the Zaisanovka 2 site situated near the Zaisanovka 1 site (see Fig. 1) (Kuzmin, Chernuk 1995), but the age of the cultural layer is uncertain.

At the Novoselishche 4 site, the palynological analysis of the Zaisanovka component shows some of the grass (*Poaceae*) pollen (content about 0.4-3.3% of total non-arboreal palynomorphs) is thought to be from cultivated species due to its large size (Verkhovskaya, Esipenko 1993). This is supported by archaeobotanical materials from this site (see above).

Overall, the data on the pollen of cultivated cereals from some Late Neolithic settlements in Primorye provide additional evidence in favour of agriculture emergence in the Zaisanovka cultural context.

Concepts and models of the emergence of agriculture in the Russian Far East

Okladnikov-Brodiansky's paradigm of 'Far Eastern nidus of plant cultivation' in 1960s

The first concept of the emergence of agriculture in the Russian Far East was that of Aleksey P. Okladnikov and David L. Brodiansky (1969), who proposed the existence of an independent 'nidus' (*i.e.* centre) of plant domestication in the Neolithic and Palaeometal period (Bronze Age and Early Iron Age), particularly for millet and soybeans. Their Far Eastern 'nidus' covers territories of Primorye, Korea, and Northeast China (Manchuria) (Okladnikov, Brodiansky 1969:13). As a factual basis, Okladnikov and Brodiansky (1969) employed mostly indirect evidence, such as the presence of hoes, ripping knives, and querns, along with a few domesticated millet seed finds in the Bronze Age (Kirovsky site; later associated with the Neolithic) and Early Iron Age complexes. Pottery, associated with the earliest agriculture complexes in Primorye, according to Okladnikov and Brodiansky (1969), has 'vertical zigzag' and meander decorations. It was pointed out that their Far Eastern centre of domestication was in some kind of contact with other parts of greater East Asia, where agriculture was known in the Neolithic, primarily with the Yangshao culture of North China (Okladnikov, Brodiansky 1969:13–14).

On the basis of modern state of knowledge of prehistoric East Asian agriculture (*e.g.*, Crawford 2006), Okladnikov and Brodiansky's (1969) ideas may generally be said to fit the factual data, as well as some details. The earliest millet agriculture in Northeast Asia is now known from Early Neolithic complexes in southern Manchuria, dated to *c.* 7500–6500 BP (*e.g.*, Shelach 2006; see also Hunt et al. 2008; Liu et al. 2009). In neighbouring Korea and Primorye, the earliest direct evidence of agriculture dates to the Late Neolithic, *c.* 4600 BP (Crawford, Lee 2003; Kuzmin et al. 1998b).

Kuzmin's concept of age and source of agriculture in the Russian Far East in 1990s–2000s

In the mid-late 1980s, a programme of extensive ¹⁴C dating of prehistoric cultural complexes in the Russian Far East was initiated by the author (see summaries in Kuzmin 2006a; 2012a). The construction

of reliable ¹⁴C chronologies for major Palaeolithic and Neolithic complexes, along with new data on early agriculture in Primorye and adjacent Northeast Asia, allows the conclusion that the source of plant cultivation, known in the Russian Far East since *c.* 4200–3700 BP, lay in neighbouring North and Northeast China, where agricultural complexes based on millet had existed since at least at *c.* 7700–5500 BP (Kuzmin et al. 1998b:816).

According to the data available in the late 1990s (see Kuzmin 1997b; Kuzmin et al. 1998b), the most probable way in which agriculture spread within Northeast Asia in the later phases of the Neolithic (4th to 3rd millennia BC) was from the northern and northeastern parts of China toward Primorye and the Korean Peninsula (Fig. 2). The validity of Kuzmin's heuristic model of horticulture spreading from Northeast China to Primorye and Korea was attested by new direct data from these regions (Crawford, Lee 2003; Lee et al. 2007; Choe, Bale 2002; Sergusheva 2007a). This new information is now incorporated into the updated author's concept of the appearance of the earliest agriculture in the Russian Far East (see Kuzmin 2010a; 2012a; Kuzmin, Rakov 2011; Kuzmin et al. 2009).

Vostretsov's model of interaction between maritime and agricultural adaptations in 1990s–2000s

Yuri E. Vostretsov (1999; 2006; 2010; see also Sergusheva, Vostretsov 2009) created a concept of interaction between maritime-adapted cultural complexes of the Primorye's coast and migrating populations with knowledge of agriculture. He proposed four 'turning points' when changes in cultural traditions occurred in Primorye in the Middle-Late Holocene: 5400–5200 BP, 4700–4300 BP, 3600–3300 BP, and 2500–2200 BP; all these intervals are correlated with cooling of the atmosphere and falls in sea level (*e.g.*, Vostretsov 2006). He connects the beginning of agriculture in south-western Primorye with the first interval, 5400–5200 BP. It has been stated that during the second and fourth intervals (*i.e.* 4700–4300 BP and 2500–2200 BP) "landscape changes destroyed the traditional subsistence base of hunters and fishermen" (Vostretsov 2006:27). During the second interval, 4700–4300 BP, bearers of the Zaisanovka complex with evidence of millet farming began to spread in southern and central parts of Primorye (Vostretsov 2006:28). As a summary, it is postulated that "agriculture spreads into new territories following certain ecological stresses that disrupt traditional resource bases and sub-

sistence strategies and cause depopulation." (Vostretsov 2006.31).

However, these statements contradict the original data, as was highlighted in several recent publications (e.g., Kuzmin 2012a.733; Kuzmin, Rakov 2011.106–107). Firstly, the earliest direct traces of agriculture in Primorye are known from the Zaisanovka component of the Krounovka 1 site dated to c. 4670–4640 BP (Komoto, Obata 2004; also see above). There is no evidence of agriculture practice at the Krounovka 1 or other sites in Primorye prior to this time, and Vostretsov's (2006) first 'turning point' of 5400–5200 BP is not supported by solid facts.

Secondly, the destruction of the maritime-oriented resource base and subsistence strategies during the second 'turning point' at c. 4700–4300 BP is unjustified. At that time, the maritime economy is known in southernmost Primorye at the Zaisanovka 7 site. This settlement existed at c. 4500–4400 BP (Komoto, Obata 2004; 2005; Kuzmin 2012a.732). It is represented by a series of shell middens with abundant remains of marine molluscs and fish, along with some terrestrial mammals (Komoto, Obata 2005). Thus, the maritime economy continued to exist in southern Primorye after its suggested decline at c. 5000 BP (e.g., Vostretsov 2006.28).

Unfortunately, several other discrepancies exist in Vostretsov's publications. For example, in the description of the interaction between maritime and agricultural adaptations, Vostretsov (1999.323) states that "*in the north-west sector of the Japan Sea and eastern Korea, the intensification of maritime adaptation strategies is connected with the cooling and regression of the sea*". However, in other papers (e.g., Vostretsov 2006.28) the cooling at c. 5000 BP is correlated with a decline in maritime-adapted complexes (such as the Boisman culture of southern Primorye, see above) and the appearance of agricultural populations, which migrated from neighbouring Manchuria. It is unclear to me which of these statements is correct.

The source of prehistoric agriculture in the Russian Far East

As for the possible source of agricultural tradition in Primorye, in my opinion, Northeast China seems to be the most reasonable choice (Fig. 2). The latest research allows us to establish firmly the presence of millet seeds in the Xinglongwa culture of Manchuria

(see Lee et al. 2007.1087), now dated to c. 7470–5660 BP, with the majority of ¹⁴C dates clustering at c. 7470–6530 BP (c. 6200–5100 calBC) (Shelach 2006). Crawford (2006.82) assumed that the Xinglongwa complex with finds of broomcorn and foxtail millets could be as old as c. 8000–7000 BP. The pottery from the Xinglongwa site has mostly impressed zigzag design (Guo 1995). Yanshina and Klyuev (2005.199) found definite common patterns in pottery designs from the Zaisanovka complex in Primorye and the Neolithic cultures in Manchuria, such as Xinglongwa, Cishan, Yaojinzi, Fuhe, and Hongshan.

It seems that the whole region between the Liao River basin of Manchuria and southern Primorye of the Russian Far East had been in a state of active contact since the Neolithic and perhaps even earlier, the late Upper Palaeolithic (c. 10 000–15 000 BP). This is supported by other secure line of evidence such as the transportation and/or exchange of obsidian in Northeast Asia between prehistoric Korea, Manchuria, and Primorye (Kuzmin 2010b; 2011; Kuzmin et al. 2002).

Therefore, it seems logical that the Early Neolithic agricultural populations of Manchuria with impressed pottery began to spread toward the adjacent Russian Far East (mainly Primorye) and the Korean Peninsula after c. 5000 BP (Fig. 2), bringing their knowledge of plant cultivation. This is in accord with archaeological and archaeobotanical data from these two regions, where the first reliable traces of millet cultivation are now dated to at least c. 4600 BP (Crawford, Lee 2003), and it broadly confirms our earlier suggestion about the dissemination routes of millet agriculture in Northeast Asia (Kuzmin et al. 1998b). In North China, the beginning of millet agriculture is now dated to an even earlier time, c. 9210 BP (c. 8610–8290 calBC), in the Early Neolithic context of the Cishan site (Lu et al. 2009; see also Crawford 2009; Kuzmin et al. 2009.896–897).

Concerning the mechanism whereby millet agriculture spread from a Chinese centre to its periphery, diffusion seems to be the most suitable explanation, as suggested before (Kuzmin et al. 1998b.816). The southern Russian Far East may now be added to regions where millet cultivation was introduced and expanded from a Chinese core (e.g., Bellwood 2005.7).

Conclusions

Based on the most recent direct and reliable data on the earliest agriculture in the southern Russian Far

East, the appearance of millet cultivation in Primorye can be placed at *c.* 4700–4600 BP (*c.* 3600–3400 calBC) in the context of the early Zaisanovka cultural complex of the Late Neolithic. The further development of millet agriculture is known in the late Zaisanovka culture, *c.* 3800–3300 BP (*c.* 2200–1600 cal BC). The primary Late Neolithic sites, where plant cultivation was practiced, were situated in the forest steppe area of southern Primorye, where natural conditions such as open spaces and a drier climate were favourable for millet cultivation compared to the surrounding forested areas.

Prehistoric cultural developments in the Russian Far East were a combination of local processes and influences from neighbouring regions of Northeast Asia. It is obvious today that the Russian Far East was a secondary area in terms of the origin of millet cultivation. The source region responsible for the appearance of agriculture in the Russian Far East is probably neighbouring Manchuria, where millet had been cultivated since the Early Neolithic, *c.* 7500–6500 BP (*c.* 6200–5100 calBC).

Okladnikov–Brodiansky's (1969) concept of "Far Eastern nidus of ancient agriculture" is generally correct, although it was significantly enhanced and transformed in recent decades. Vostretsov's (1999; 2006; 2010) model of maritime and agricultural adaptations and their relationship in the Neolithic of Primorye turned out to be in conflict with the primary information. Attempts to find a direct correlation between the climatic fluctuations and changes in human subsistence (*e.g.*, Vostretsov 2006; 2010; Sergusheva, Vostretsov 2009) seem to be unproductive. Perhaps, the relationship between these two processes in the Russian Far East was quite 'non-linear', and more work needs to be done in order to identify the major driving force(s) which caused changes in human adaptive strategies in the Neolithic, including the beginning of agriculture.

As for the spatial-temporal relationship between pottery and agriculture, it is now clear that in the Rus-

sian Far East the emergence of pottery was not related to the origin of plant cultivation (see Kuzmin 2013). This feature is generally quite common in Northeast Asia, where the earliest pottery complexes dated to *c.* 13 700–13 300 BP (*e.g.*, Kuzmin 2010c), while rice and millet agriculture appeared at least several millennia later (*e.g.*, Bellwood 2005; Crawford 2006).

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