Quaternary International 441 (2017) 29–35

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

# The origins of pottery in East Asia and neighboring regions: An analysis based on radiocarbon data

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A R T I C L E I N F O

*Article history:*
Received 8 March 2016
Received in revised form
5 October 2016
Accepted 10 October 2016
Available online 1 March 2017

*Keywords:*
Pottery
Radiocarbon dating
East Asia
China
Japan
Russian Far East
Siberia
Transbaikal

A B S T R A C T

Patterns for the emergence of pottery-making in greater East Asia based on radiocarbon dates associated with the earliest pottery assemblages are presented. According to a critical evaluation of the existing evidence, the oldest centers with pottery in East Asia are located in South China (dated to ca. 18,000 cal BP), the Japanese Islands (ca. 16,700 cal BP), and the Russian Far East (ca. 15,900 cal BP). The claim for earlier pottery in South China at the Xianrendong Cave, supposedly dated to ca. 20,000 cal BP, cannot be substantiated. The appearance of pottery in other parts of greater East Asia was a slow process, without clear diffusion from any of these centers toward the periphery. In neighboring Siberia, the oldest pottery dated to ca. 14,000 cal BP is known from the Transbaikal.



## 1. Introduction

The emergence of pottery is one of the most important phenomena in prehistory (e.g., Jordan and Zvelebil, 2009; Kuzmin, 2013). It is widely accepted that the oldest vessels made of fired clay appeared first in greater East Asia, but discussions about the geographic position and timing of the earliest pottery-making cultural complexes are ongoing (Wu et al., 2012; Kuzmin, 2013, 2015; Cohen, 2013). The analysis of chronological patterns for the emergence of pottery in greater East Asia (as of mid-2016) is the main focus of this paper; the data from neighboring Siberia and Mongolia are also considered.

## 2. Material and methods

In order to conduct analysis of the earliest pottery complexes from chronological perspective, recent overviews on the emergence of pottery among hunter–gatherers in East Asia and neighboring regions are used here as a background (Kuzmin, 2013, 2015; Gibbs and Jordan, 2013, 2016; Gibbs, 2015; Jordan et al., 2016). The evaluation of $^{14}$C dates for the early pottery complexes, as performed here, is critical for understanding the origins and spread of ceramics in the entire Old World. The newly published data on the early pottery from the Transbaikal (southern part of Eastern Siberia) (Razgildeeva et al., 2013) are included into the existing dataset for this region after examination. The calibration of $^{14}$C dates was conducted with the help of the Calib 7.0.2 software (see Reimer et al., 2013), at ± 2-sigma, and all possible intervals are combined and rounded to the next ten years. Archaeological data, especially on the shape, decoration, and technological traits of the earliest pottery in East Asia (e.g. Kaner, 2009; Kobayashi, 2004; Lu, 2010; Pearson, 2005; Zhushchikhovskaya, 2005, 2009; see also Kuzmin, 2015), were also taken into account.

## 3. Results and discussion

### 3.1. South China

As is well-known, this region contains sites with very old pottery (e.g. Boaretto et al., 2009; Lu, 2010; Pearson, 2005; Wu et al., 2012). However, not all the $^{14}$C records from southern Chinese

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http://dx.doi.org/10.1016/j.quaint.2016.10.011
1040-6182/

sites are of equal quality, as it was pointed out before (e.g. Kuzmin, 2006). Therefore, analysis of the reliability for the chronological control for these sites ("chronometric hygiene" *sensu* Spriggs, 1989) is required.

The results of the latest studies at the Xianrendong Cave in southern China (Fig. 1) were published by Wu et al. (2012), with the $^{14}$C dates of the site's oldest component with pottery at ca. 16,915 BP (western section), corresponding to a calibrated age range of 19,950–20,880 cal BP. If we accept this conclusion at face value, this would be the oldest pottery in the Old World.

However, several important issues should be taken into account when evaluating the reliability of these dates (Table 1): 1) the stratigraphic association between the $^{14}$C-dated bone samples and the potsherds is not proven (see Wu et al., 2012: 1697); 2) a $^{14}$C value of 12,530 ± 140 BP (BA95145) (Table 1) obtained previously from Unit 3C1A, the second earliest site component with pottery, was ignored by Wu et al. (2012); and 3) some $^{14}$C dates, which do not fit the age model suggested by Wu et al. (2012) (see Table 1), were declared as 'outliers' without any reasonable explanation.

The fundamental difference between studies conducted at the Xianrendong site by Wu et al. (2012) and MacNeish (1999; see also MacNeish and Libby, 1995) is that the former team was not allowed to excavate before sampling (see Wu et al., 2012: 1697), while in the latter case a small part of the site's profile was excavated in 1993–1995 (MacNeish and Libby, 1995), with stratigraphic positions of pottery and samples for $^{14}$C dates securely documented. Therefore, the reliability of the $^{14}$C dating results obtained by Wu et al. (2012) was based totally on the results of excavation conducted by Chinese scholars after the R.S. MacNeish-led works (see Wu et al., 2012: 1697), and great caution should be used when these data are considered. In the latest publication (Cohen et al., 2016), it is stated that there are a few outliers in the Xianrendong $^{14}$C records but this again contradicts to what was published before by Wu et al. (2012) (see Table 1). Cohen et al. (2016) ignore the BA00009 date which is significantly younger that the rest of $^{14}$C values from Layer 3C1B with the earliest pottery (see Table 1). No explanations are given, and it can be assumed that there still many stratigraphic problems at the Xianrendong site which are not solved.

The disturbed nature of the Xianrendong Cave stratigraphy is demonstrated in Table 1 by several age–layer reversals. As a result, the chronological model created by Wu et al. (2012) is heavily biased toward the older $^{14}$C dates, and cannot be accepted as a reliable estimate for the pottery-containing strata of this site due to uncertainty between the stratigraphic position of potsherds and bones selected for $^{14}$C dating. According to a conservative age estimate approach (i.e. "chronometric hygiene"), the pottery from this site should be dated to ca. 14,700 cal BP, following the $^{14}$C age of 12,530 ± 140 BP (BA-95145) from the overlying stratum 3C1A (see Table 1), as the youngest reliable value from this layer. Therefore, it would seem necessary to remove the Xianrendong Cave from the corpus of the earliest pottery sites in South China.

At the Yuchanyan Cave, samples for $^{14}$C dating were collected

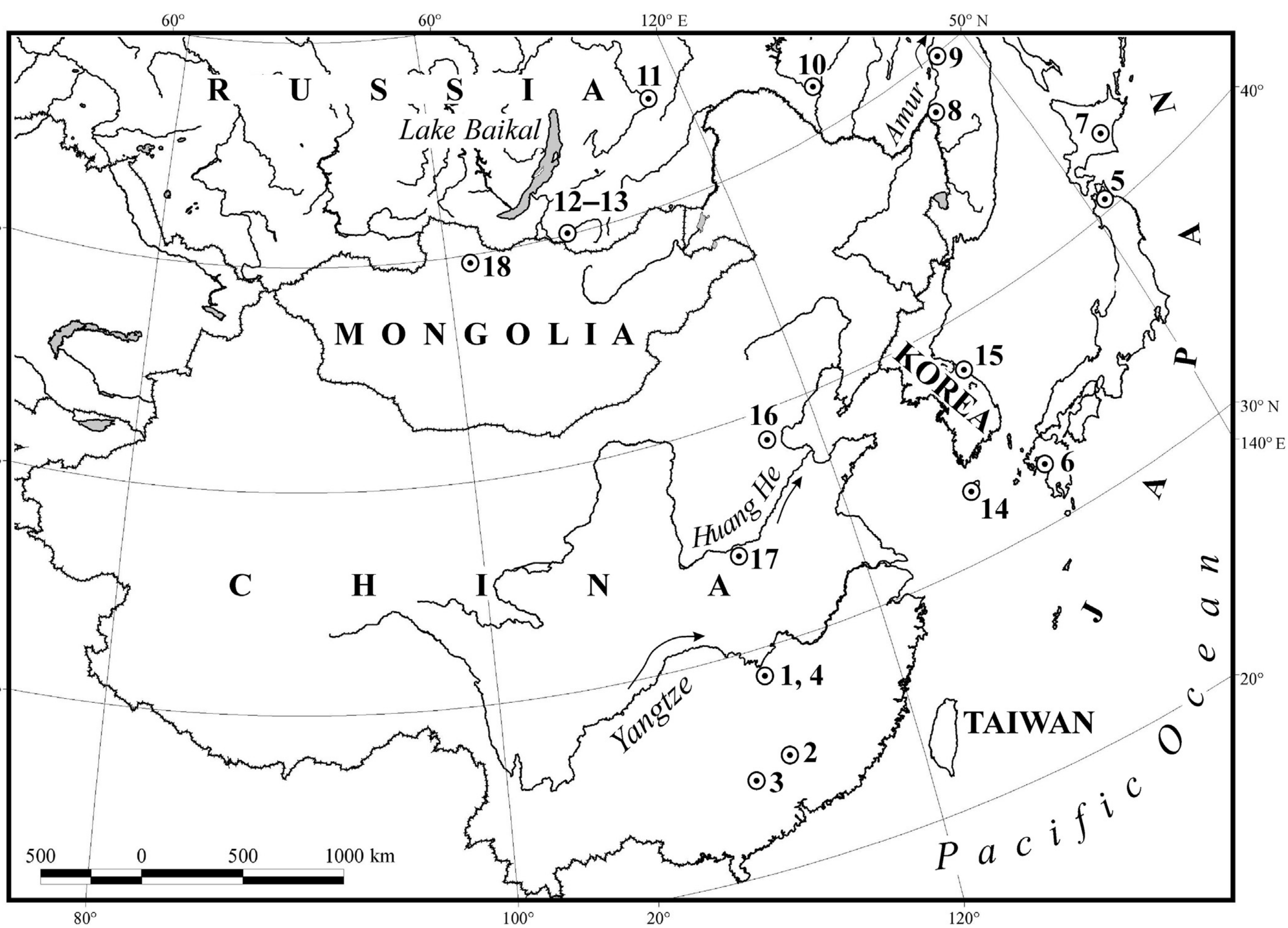


**Fig. 1.** Position of archaeological sites mentioned in the text and Tables 1 and 2: 1 – Xianrendong Cave; 2 – Yuchanyan Cave; 3 – Miaoyan Cave; 4 – Wang Dong Cave; 5 – Odai Yamamoto 1; 6 – Senpukuji Cave; 7 – Taisho 3; 8 – Gasya; 9 – Khummi; 10 – Gromatukha; 11 – Ust-Karenga 12; 12 – Studenoe 1; 13 – Ust-Menza 1; 14 – Kosanni; 15 – Osanni; 16 – Nazhuangtou; 17 – Lijiagou and Lingjing; 18 – Tolbor 15.

**Table 1**
The $^{14}C$ dates from the western section of Xianrendong Cave, China (discordant dates are in bold).

| Unit/Layer | $^{14}C$ date, BP | Lab Code | Material dated | Calendar age, cal BP[a] | Reference | Note |
|---|---|---|---|---|---|---|
| ***Early pottery layers*** | | | | | | |
| 3B1[b] | **14,610 ± 290** | BA093181 | Charcoal | 17,030–18,480 | Wu et al. (2012) | Date is in discord with $^{14}C$ age from Layer 3B2 below |
| 3B2[b] | **12,420 ± 80** | UCR3561[f] | Human bone | 14,150–14,970 | Wu et al. (2012) | Date is in discord with $^{14}C$ age from Layer 3B1 above |
| 3C1A[c] | 14,235 ± 60 | BA09872 | Animal bone | 17,120–17,540 | Wu et al. (2012) | |
| 3C1A | 14,925 ± 70 | BA09868 | Animal bone | 17,940–18,340 | Wu et al. (2012) | |
| 3C1A | **13,885 ± 55** | BA09875 | Animal bone | 16,560–17,050 | Wu et al. (2012) | Date is in discord with $^{14}C$ ages above and below |
| 3C1A | 15,165 ± 55 | BA09874 | Animal bone | 18,270–18,600 | Wu et al. (2012) | |
| 3C1A | 15,655 ± 194 | BA00006 | Animal bone | 18,530–19,420 | Wu et al. (2012) | |
| 3C1A | 16,010 ± 70 | UCR3562 | Human bone | 19,090–19,550 | Wu et al. (2012) | |
| 3C1A | 16,340 ± 200 | BA95143 | Charcoal | 19,200–20,210 | Wu et al. (2012) | |
| 3C1A | **14,160 ± 140** | UCR-3440[g] | Charcoal | 16,770–17,620 | MacNeish (1999) | Date is in discord with $^{14}C$ ages above and below |
| 3C1A | **12,530 ± 140** | BA-95145[h] | Charcoal | 14,170–15,220 | MacNeish (1999) | Date is in discord with $^{14}C$ ages above and below |
| 3C1B[c] | 16,165 ± 55 | BA10264 | Animal bone | 19,300–19,700 | Wu et al. (2012) | |
| 3C1B | 16,485 ± 55 | BA10266 | Animal bone | 19,660–20,080 | Wu et al. (2012) | |
| 3C1B | **16,730 ± 120** | UCR3439 | Charcoal | 19,880–20,510 | Wu et al. (2012) | Date is in discord with $^{14}C$ age of ca. 15,960 BP below |
| 3C1B | **16,915 ± 186** | BA00007 | Animal bone | 19,950–20,880 | Wu et al. (2012) | Date is in discord with $^{14}C$ age of ca. 15,960 BP below |
| 3C1B | **17,420 ± 130** | AA15005[d] | Charcoal | 20,660–21,430 | Wu et al. (2012) | Date is in discord with $^{14}C$ age of ca. 15,960 BP below |
| 3C1B | **18,520 ± 140** | UCR3440[g] | Charcoal | 21,980–22,690 | Wu et al. (2012) | Date is in discord with $^{14}C$ ages below |
| 3C1B | **15,960 ± 190** | BA00009 | Animal bone | 18,820–19,710 | Kuzmin (2006) [e] | Date is in discord with $^{14}C$ ages above and below |
| ***Pre-pottery layers*** | | | | | | |
| 3C2 | **15,180 ± 90** | UCR3300[i] | Human bone | 18,190–18,670 | Wu et al. (2012) | Date is in discord with $^{14}C$ ages above and below |
| 3C2 | **17,580 ± 80** | UCR3522 | Charcoal | 20,960–21,530 | Wu et al. (2012) | Date is in discord with $^{14}C$ age of ca. 18,520 BP above |
| 3C2 | **17,915 ± 80** | BA09878 | Animal bone | 21,440–21,930 | Wu et al. (2012) | Date is in discord with $^{14}C$ age of ca. 18,520 BP above |
| 3C2 | 17,983 ± 177 | BA00008 | Animal bone | 21,300–22,290 | Wu et al. (2012) | |
| 3C2 | 18,110 ± 270 | BA93182 | Charcoal | 21,210–22,500 | Wu et al. (2012) | |

[a] The IntCal13 dataset (Reimer et al., 2013) was used.
[b] These layers represent the Wang phase with pottery (see MacNeish, 1999; MacNeish et al., 1998).
[c] This is the site's earliest component with pottery, the Xian Ren phase (see MacNeish, 1999; MacNeish et al., 1998).
[d] In MacNeish and Libby (1995: 83) and Kuzmin (2006), the Lab No. is given as AA-15008.
[e] Originally published as 16,440 ± 90 BP in Wu and Zhao (2003: 18).
[f] In Kuzmin (2006: 365), this date is mistakenly associated with Unit 3C1B.
[g] There is a discrepancy between MacNeish (1999: 238) and MacNeish et al. (1998: 37) and Wu et al. (2012: 1698) to which unit this UCR-3440 value belongs; for safety, it is probably better to remove it from the list of $^{14}C$ dates of Xianrendong Cave.
[h] This is the most reliable age estimate for the underlying Unit 3C1B (see the text).
[i] The stratigraphic position of this sample is not entirely clear (see MacNeish et al., 1998: 83); it could also belong to Unit 3C1B.

during the excavations in 2004–2005 (Boaretto et al., 2009), and stratigraphic control was adequate for correlation of the $^{14}C$-dated specimens and pottery. Also, the age–depth profile for $^{14}C$ values looks quite straightforward (Boaretto et al., 2009: 9599). Thus, the age of the oldest pottery-containing stratum at the Yuchanyan Cave as ca. 18,000 cal BP can be accepted as a reliable.

For the Miaoyan Cave, no direct $^{14}C$ date was received from the middle part of Layer 5 with pottery (Yuan et al., 1995). The age of the overlying Layer 4M is ca. 16,600 cal BP (Table 2). Two other $^{14}C$ values, 15,120 ± 500 BP (BA94137a) and 15,220 ± 260 BP (BA94137b), were generated from Layer 5 on humic acids and potsherd residues, respectively (see Wu and Zhao, 2003: 18). These materials cannot be accepted as reliable for the determination of the $^{14}C$ age of the pottery-containing stratum (e.g. Kuzmin, 2013: 540–544). Therefore, the conservative age estimate of for the earliest pottery at Miaoyan Cave should be based on the charcoal $^{14}C$ value from Layer 4M (see Table 2).

As for the Wang Dong Cave [Diaotonghuan], critical evaluation of $^{14}C$ records by Kuzmin (2006: 365) allowed estimation of the age of the earliest pottery-bearing stratum at ca. 13,400 cal BP (Table 2). Concerns about the "… ambiguities in the stratigraphic sequences …" (Boaretto et al., 2009: 9599) for this site and the Xianrendong Cave were expressed before (e.g. Boaretto et al., 2009; Kuzmin, 2006, 2015), although some authors (e.g. Jordan et al., 2016; Li et al., 2016) accept the very early age of the latter site.

Upon critical analysis of the $^{14}C$ records from the earliest Chinese sites with pottery (e.g. Kuzmin, 2006, 2013, 2015), it is possible to conclude that Layer 3H of Yuchanyan Cave dated to 17,830–18,190 cal BP (Table 2), centered at ca. 18,000 cal BP, represents the oldest case of pottery-making in greater East Asia (Fig. 1). For other sites in South China such as Miaoyan and Wang Dong caves (Fig. 1), the age of the earliest pottery is not older than ca. 16,600 cal BP (median value for the Miaoyan Cave, see Table 2).

### 3.2. Japanese Islands

Since the publication of summary works in the early 2000s (Keally et al., 2003, 2004) with more recent additions (see Omoto et al., 2010; Kuzmin, 2013, 2015; Morisaki and Sato, 2014), the timing for the appearance of pottery, belonging to the Incipient Jomon of Japan, has not changed. The oldest $^{14}C$ dates, ca. 13,500–13,800 BP, come from the Odai Yamamoto 1 site in the northern part of Honshu Island (Fig. 1, Table 2). Based on current knowledge, the existence of pottery on the Japanese Islands can be securely established from ca. 16,700 cal BP (median point of the oldest calibrated age of Odai Yamamoto 1 site; see Table 2) onwards, with the oldest ceramics on Kyushu Island at the Senpukuji Cave dated to ca. 14,200 cal BP, and on Hokkaido Island at the Taisho 3 site at ca. 14,600 cal BP (Table 2). Studies of the earliest Jomon pottery using the biomolecular approach were conducted in recent years (Craig et al., 2013; Lucquin et al., 2016), and they have generally confirmed previous conclusions about the chronology of the Incipient Jomon (e.g. Nakamura et al., 2001; Keally et al., 2003, 2004; Taniguchi, 2006; Yoshida et al., 2013).

### 3.3. The Russian Far East

Since analyses conducted by Kuzmin (2006, 2013) and Kuzmin and Rakov (2011), it has been accepted that the first evidence of pottery-making for this region is dated to ca. 12,960–13,260 BP in the Lower Amur River basin, corresponding to ca. 15,500–15,940 cal BP (Table 2). The median calendar age of the

**Table 2**
The earliest East Asian and Siberian sites with pottery and their selected $^{14}C$ dates (from Kuzmin, 2013, modified).[a]

| Site | $^{14}C$ date, BP | Lab Code and No. | Material dated | Calendar age, cal BP[b] | Reference |
|---|---|---|---|---|---|
| **South China** | | | | | |
| Yuchanyan Cave | 14,800 ± 55 | RTB 5464/BA06864 | Charcoal | 17,830–18,190 | Boaretto et al. (2009) |
| Miaoyan Cave | 13,710 ± 270 | BA92034-1 | Charcoal | 15,820–17,380 | Yuan et al. (1995) |
| Wang Dong Cave | 11,500 ± 150 | BK95138[c] | Charcoal | 13,060–13,700 | MacNeish (1999) |
| **North China** | | | | | |
| Nanzhuangtou | 10,210 ± 110 | BK-87075[c] | Charcoal | 11,400–12,390 | Yuan et al. (1992) |
| **Japanese Islands**[d] | | | | | |
| Odai Yamamoto 1 | 13,780 ± 170 | NUTA-6510 | Adhesion[e] | 16,170–17,180 | Nakamura et al. (2001) |
| Senpukuji Cave | 12,220 ± 80 | MTC-11296 | Adhesion | 13,820–14,520 | Sato et al. (2011) |
| Taisho 3 | 12,460 ± 40 | Beta-194629 | Adhesion | 14,270–14,960 | Yamahara (2006) |
| **Russian Far East** | | | | | |
| Khummi | 13,260 ± 100 | AA-13392 | Charcoal | 15,640–16,240 | Kuzmin et al. (1997) |
| Gasya | 12,960 ± 120 | LE-1781 | Charcoal | 15,150–15,870 | Okladnikov and Medvedev (1983) |
| Gromatukha | 12,380 ± 70 | MTC-05937 | Charcoal | 14,110–14,850 | Nesterov et al. (2006) |
| **Transbaikal (Eastern Siberia)** | | | | | |
| Ust-Karenga 12, layer 7 | 12,180 ± 60 | AA-60210 | Charcoal | 13,840–14,240 | Kuzmin and Vetrov (2007) |
| Studenoe 1, layer 9G | 11,960 ± 80 | TKa-15554 | Adhesion | 13,580–14,020 | Razgildeeva et al. (2013) |
| Ust-Menza 1, layer 8 | 11,550 ± 50 | MTC-16738 | Adhesion | 13,280–13,470 | Razgildeeva et al. (2013) |

[a] Only the oldest $^{14}C$ date for each site is listed here; for more complete information, see the relevant references.
[b] The IntCal13 dataset (Reimer et al., 2013) is used.
[c] These dates are re-calculated (see Kuzmin, 2013).
[d] Only selected oldest sites (with $^{14}C$ dates older than ca. 12,700 BP) are included; see the full list in Keally et al. (2003).
[e] Food remains on the surface of pottery (e.g. Nakamura et al., 2001).

oldest $^{14}C$ value from the Khummi site is ca. 15,900 cal BP. In some parts of the Russian Far East such as the Middle Amur River basin, pottery emerged slightly later, at ca. 12,400 BP (ca. 14,500 cal BP) at the Gromatukha site (Nesterov et al., 2006). People in the lower and middle courses of the Amur River region were in contact in the Initial Neolithic as the obsidian sourcing record shows (Glascock et al., 2011). The similar design and shapes of pottery from the Osipovka complex (Khummi and Gasya sites) in the lower part of the basin and the Gromatukha complex in the middle section of the basin (e.g. Shewkomud and Yanshina, 2012; Zhushchikhovskaya, 2012; Medvedev and Tsetlin, 2013; Kuzmin, 2015) allowed the combination of these two areas in the Amur River center of the earliest pottery in East Asia (Fig. 2). In the neighboring territories, Primorye (Maritime) Province and Sakhalin Island, the earliest pottery-bearing sites are younger at ca. 9900–12,700 cal BP (Kuzmin, 2014).

### 3.4. *Transbaikal*

Basic information about the earliest pottery from the Transbaikal can be found in Kuzmin (2015) and Kuzmin and Vetrov (2007). In the northern Transbaikal, the age of charcoal collected from Layer 7 with pottery at the Ust-Karenga 12 site is ca. 12,180 BP (ca. 14,000 cal BP) (see Table 2). As for the southern part of this region, new data were obtained and published by Razgildeeva et al. (2013). At the Studenoe 1 site, food crust attached to potsherds from Layer 9G (the lowermost stratum with pottery) was $^{14}C$-dated to ca. 11,960 BP, corresponding to ca. 13,800 cal BP (Table 2). The earliest pottery from another site in the southern Transbaikal, the Ust-Menza 1, was recently $^{14}C$-dated for the first time (Razgildeeva et al., 2013). The age of food adhesion on pottery from Layer 8 is ca. 11,500 BP (ca. 13,400 cal BP; see Table 2).

Konstantinov (2016) recently challenged the conclusions by Razgildeeva et al. (2013) because the strata with the earliest pottery at the Studenoe 1 and Ust-Menza 1 sites, in his opinion, contain paleosols enriched with humic matter. He considers this observation as evidence of a warm climate and association of these cultural layers with the Middle Holocene (climatic optimum). This, however, does not match with the cool conditions in the Late Glacial period of the southern Transbaikal, ca. 14,500–12,000 cal BP (e.g. Shichi et al., 2009), when pottery emerged in this region according to Razgildeeva et al. (2013). Also, the suggested Middle Holocene age of Layer 9 at the Studenoe 1 site is not supported by the existing $^{14}C$ chronology (see Buvit et al., 2003). Therefore, Konstantinov's (2016) position is not consistent, and the issue of the Studenoe 1 stratigraphy and chronology requires more work (see also Kuzmin, 2013: 547–548).

Konstantinov (2016) is also quite skeptical about the Late Glacial age of the earliest pottery from the Ust-Karenga 12 site, because Layer 7, in his opinion, is associated with the Middle Holocene due to presence of humic matter in this layer which looks like a paleosol. This again contradicts the $^{14}C$ chronology of this site (e.g. Kuzmin and Vetrov, 2007), and the fact that there is a well-developed paleosol in Layer 4 of the Ust-Karenga 12 profile, $^{14}C$-dated to ca. 6100–6890 BP. This stratum has a much higher potential to be associated with the Middle Holocene than Layer 7 (see Kuzmin and Vetrov, 2007: 11–12, Figs. 3–5). It seems that Konstantinov's (2016) conclusion contradicts the existing evidence.

## 4. Chronological aspects of pottery origin in East Asia and neighboring regions

Based on the data obtained, three major centers of pottery emergence in greater East Asia can be suggested: 1) South China; 2) the Japanese Islands; and 3) the Russian Far East (Amur River basin) (Fig. 2). Chronology for the oldest pottery in East Asia can be considered as secure because it is based on critical analysis of the existing evidence (e.g. Kuzmin, 2006, 2013, 2015).

However, judging from chronological point of view, there are no time-progressive patterns in terms of a possible spread of pottery-making from these centers to the neighboring regions. The earliest pottery on the Korean Peninsula is dated to ca. 11,800–8000 cal BP (Bae and Kim, 2003; Choe and Bale, 2002) (Fig. 2). As for China north of the Yangtze River, the earliest pottery is known from the Nanzhuangtou site, ca. 11,900 cal BP (Table 2). Two sites further south, in the Yangtze River basin, have slightly younger dates (Fig. 1). The Lijiagou site yielded pottery dated to ca. 10,400 cal BP (Wang et al., 2015); and the age of pottery at the Lingjing site can be estimated as ca. 9800 cal BP (Li et al., 2016). In the Transbaikal region north of East Asia, new data show the very early appearance

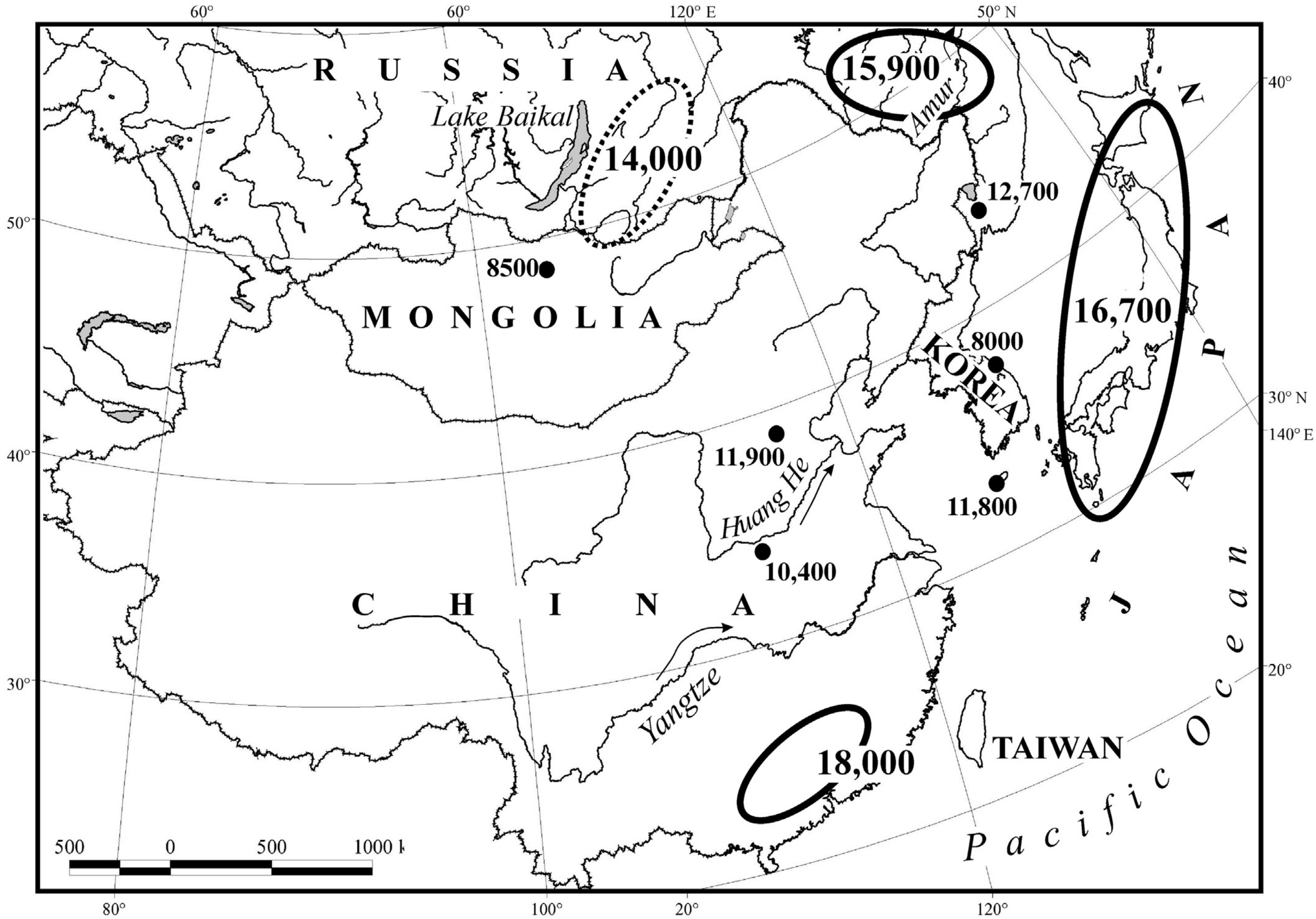


**Fig. 2.** The timing for the emergence of pottery in greater East Asia (in cal BP). Three main centers are labeled as "18,000" (South China), "16,700" (Japan), and "15,900" (Amur River basin).

of pottery, at ca. 14,000 cal BP, most probably independent from the primary East Asian centers (see details in Kuzmin, 2014, 2015). In Mongolia, the age of the oldest pottery can be estimated at ca. 8500 cal BP (e.g. Kuzmin, 2014: 720).

It is clear that the amount of data about the earliest pottery complexes in mainland East Asia (China, Russian Far East, and Korea) is still quite limited, and it is hard to determine what the mechanism of pottery emergence was – independent invention ("local development") or spread from a single original core ("diffusion"). Other lines of evidence, such as ancient and modern DNA studies and raw material exchange, were employed to see if there were any significant movements/migrations of people in the post-Last Glacial Maximum times in greater East Asia (see Kuzmin, 2013: 548–549, and references therein). The analysis of known data shows that no solid information exists today to suggest that there were active contacts between the three suggested centers of pottery emergence in East Asia.

It is not scientifically correct, in my view, to assume that there were cultural influences from one region to other territories in East Asia or broader Eurasia without convincing data in favor of such suggestions. In order to invent pottery, only two things are necessary: 1) availability of clay; and 2) knowledge of fire technology, and Paleolithic people were familiar with both of them well before the appearance of pottery in East Asia (e.g. Darvill, 2002: 338; Vandiver and Vasil'ev, 2002; Vandiver et al., 1989; see also Kuzmin, 2013).

As it was stated before (Kuzmin, 2015), no sites with pottery are known between the three suggested centers of origin (South China, Japan, and the Russian Far East) prior to ca. 11,900 cal BP. A recent study by Jordan et al. (2016: 597) also shows the emergence of pottery-making in three separate regions of East Asia at ca. 16,000 cal BP, and its merging at ca. 12,000–11,000 cal BP. Therefore, no evident exchange of pottery-making technology occurred in the Late Glacial of East Asia (Fig. 2), and it is not possible to make conclusion about the single center of pottery origins, presumably in South China, and its spread to adjacent parts of East Asia.

Concerning the continuation of chronological analysis of the pottery emergence of in northern Eurasia, it is clear today that the amount of data for some parts of this vast region is still relatively small (e.g. Kuzmin, 2014; Jordan et al., 2016). The mechanistic temporal approximation of $^{14}$C-dated localities with pottery known today, without taking into account the degree of reliability for $^{14}$C records (see, for example, discussion in Kuzmin and Vetrov, 2007: 14–15), can lead to erroneous conclusions.

As for possible factor(s) which caused the invention of pottery in different parts of East Asia among hunter–fisher–gatherers, a recent discussion and references to original sources can be found in Kuzmin (2013). According to his opinion, "The appearance of pottery was most probably facilitated by the necessity for East Asian populations in the Late Glacial (after *c.* 16,000 BP, or *c.* 19,000 cal. BP) to have light, easily made containers for the processing and storing of such types of food as wild plants and their nuts and fruit, which are otherwise hard to utilize without vessels for boiling and leaching." (Kuzmin, 2013: 551). This is in accord with previous opinions (e.g. Medvedev, 1995; Rice, 1999; Pearson, 2005; Zhushchikhovskaya, 2005). Recent studies in Japan confirmed that the main function of pottery was utilitarian, for the processing of raw foods (see Craig et al., 2013; Lucquin et al., 2016).

## 5. Conclusions

Based on solid evidence, there are three regions in greater East Asia, namely South China, the Japanese Islands, and the Russian Far East, with the oldest records of pottery-making, and it most likely emerged in each of them independently. In neighboring Siberia, the oldest pottery is now known from the Transbaikal region, dated to ca. 14,000 cal BP. No primary data on chronology of the earliest pottery complexes supports the diffusion of pottery-making technology in northern Asia from these centers to the adjacent territories. Due to the small number of $^{14}$C-dated sites with the earliest pottery in northern Eurasia, particularly in Siberia, the increase in the amount of information is an urgent task.

## Acknowledgments

I am grateful to Prof. Hiroyuki Sato and Dr. Kazuki Morisaki for their invitation to participate in this volume, and to four anonymous reviewers for their comments and suggestions. This paper is based on a poster presented at the XIX-th INQUA Congress, Nagoya, Japan (2015), as part of the Session "Emergence of the World's Oldest Pottery and its Environmental Background". Dr. Susan Keates kindly checked the grammar of the manuscript, and I am thankful for that. This paper in dedicated to the memory of my colleague and friend Dr. Igor Y. Shewkomud (1963–2015) who excavated some of the earliest pottery sites in the Amur River basin. This research was supported by the Japan Society for the Promotion of Science; by the State Assignment Project 72 of the Russian Academy of Sciences (section 0330-2016-0018); and by a grant from Tomsk State University "D.I. Mendeleev Academic Fund" Program (2016–2017).

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