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A comparative perspective on the ‘western’ and ‘eastern’ Neolithics of Eurasia: Ceramics; agriculture and sedentism

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ABSTRACT

The Neolithic is a key topic in the study of Old World prehistory but how the Neolithic is defined varies between regions. In East Asia the invention of pottery is often seen as marking the start of the Neolithic. In contrast to this ‘eastern’ perspective, in western parts of Eurasia it is the presence of agriculture that usually defines the onset of a Neolithic way of life. This paper adopts a comparative perspective, examining the origins and development of pottery, agriculture and sedentary life in East Asia and Southwest Asia. We suggest that a comparative perspective indicates that some of the most enduring themes of Neolithic studies need to be reconsidered, namely: (1) the idea of a Neolithic package consisting of a number of associated traits (including, among other things, agriculture, sedentary sites, and pottery) that developed and spread together; (2) the notion of the Neolithic as a revolutionary event marking a sharp break from the preceding Palaeolithic period, and (3) the enduring impact of the Neolithic on later periods.

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1. Introduction

Several papers in this special issue demonstrate the benefits of adopting a comparative perspective when studying the archaeology of hunter–gatherer communities in Northeast Asia. As recent discussions of Late Pleistocene and Early Holocene archaeology in this region have sometimes emphasized processes of ‘Neolithization’ (e.g. Uchiyama et al., 2014 and other articles in the December 2014 *Journal of World Prehistory* special issue; Kuzmin, 2013b) it may be useful to draw general comparisons with other areas that experienced notably different Neolithic processes. This paper compares cultural, economic and technological developments that are often associated with the origins of the Neolithic in two regions (Fig. 1): East Asia (including China, Japan and the Russian Far East) and Southwest Asia (i.e. the Near East). Our comparative approach examines the origins of pottery, agriculture and sedentism to highlight similarities and differences in the timing and cultural content of Neolithic trajectories in these two regions that can contribute to a general understanding of processes of Neolithization.

The Neolithic is a key topic in the study of Old World prehistory. Among the most enduring themes of Neolithic studies are (1) the idea of a Neolithic package consisting of a number of associated traits (including, among other things, agriculture, sedentary sites, and pottery) that developed and spread together; (2) the notion of the Neolithic as a revolutionary event marking a sharp break from the preceding Palaeolithic period, and (3) the enduring impact of the Neolithic on later periods. In both East Asia and Southwest Asia these themes have led to the characterization of the Neolithic as an important and clearly delineated stage in human development. Early and mid-twentieth century culture-historical views on archaeological stages including the Neolithic tended to imply periods of stasis separated by rapid changes. In both East Asia and Southwest Asia, more recent perspectives on the Neolithic have emphasized its development as a process of ‘Neolithization’ that saw the co-development of a number of inter-related economic, technological, social and symbolic features.

Despite the shift to viewing the Neolithic as a long-term process, there remain key features that are used to designate a site or culture as Neolithic but these features are not consistent across Eurasia. In western traditions the Neolithic is defined primarily by an economic strategy. Here the presence of agriculture-based economies, rather than ones based on hunting and gathering, separates the Neolithic from earlier Palaeolithic cultures. This agricultural Neolithic is thought to have developed first in Southwest Asia and

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Fig. 1. Maps of Southwest Asia (A) and East Asia (B) showing sites mentioned in the text. Insets show examples of pottery from Tabaqat al-Bûma (left) and Torihama (right): 1. Kfar HaHoresh; 2. Tabaqat al-Bûma; 3. Ohalo II; 4. Ain Mallaha (Eynan); 5. Abu Hureyra; 6. Tell Sabi Abyad; 7. Ganj Dareh; 8. Zengpiyan; 9. Yuchanyan Cave; 10. Shangshan; 11. Kua-huqiao; 12. Xianrendong; 13. Jiahu; 14. Shizitan 9 and 14; 15. Cishan; 16. Donghulin; 17. Boisman 2; 18. Gromatukha; 19. Goncharka; 20. Gasya; 21. Khummi; 22. Taisho 3; 23. Nakano B; 24. Odai Yamomoto 1; 25. Kitihara; 26. Torihama; 27. Awazu; 28. Kakoinohara, Kakuriyama and Sojiyama.

then spread to neighboring regions, including Europe and parts of Central Asia. In contrast, in eastern traditions the Neolithic is often defined by a technological development: the invention of pottery (Chard, 1974:63; Barnes, 1999:17). This is perhaps most explicit in Russian archaeology (e.g. Kuzmin, 2006, 2013b; Jordan and Zvelebil, 2009: 48) but the pottery-using Jomon hunter-gatherers of Japan have also been viewed as a Neolithic culture (Habu, 2004:243) and in China the presence of pottery has been used as a marker for the Neolithic (Cohen, 2011:S274), although the comparatively early appearance of agriculture here has led to its emphasis in recent definitions of the Chinese Neolithic and the earliest Chinese pottery is sometimes described as an Upper Palaeolithic invention (e.g. Bar-Yosef and Wang, 2012).

In this paper we adopt a comparative approach to the study of Neolithization focusing on these key features—agriculture and pottery. We also consider evidence for sedentary sites in each of these regions, as sedentism is often considered important for the establishment of both agricultural economies and pottery production (Arnold, 1985). Comparative perspectives in archaeology can take different forms (McNett, 1979). Broad ‘systemic’ comparative studies (Smith and Peregrine, 2012) incorporate data from many cultural areas in a region or across the globe in order to develop statistically testable theories about human behavior, sometimes incorporating both archaeological and ethnographic evidence (e.g. Peregrine, 2001). For the comparative study of the Neolithic this approach can be problematic because in world prehistory a relatively small number of places witnessed the early and independent innovation of notable Neolithic developments (Rice, 1999; Barker, 2006; cf.; Fuller, 2010). For this reason this paper adopts a more ‘intensive’ comparative approach (Smith and Peregrine, 2012) that considers the Neolithic in only two areas—East Asia and Southwest Asia.

Arguably, on some levels, these two regions have little in common and a more obvious comparison might be between Northeast Asia and Northwest Europe, since these regions have more similar climates and geographies, and were at various points occupied by pottery-using hunter-gatherers. However, East Asia and Southwest Asia are significant for any general discussion of the origins of Old World Neolithization as they have both produced early evidence for

plant and animal management, pottery production and sedentary sites. Furthermore, important Neolithic developments that first occurred in these regions eventually dispersed into new areas, giving the East and Southwest Asian ‘source’ areas significance for discussions of Neolithization in other parts of the Old World, such as northern Europe. More generally, as noted by Meskell and Joyce (2003), investigating the same issues in different times and places can expose unexamined postulates and can lead to productive new avenues of research.

Relatively few studies have directly compared the content and timing of Neolithic trajectories in East Asia and West Asia, although both regions are frequently included in broader comparative studies (e.g. Rice, 1999; Bellwood, 2005; Barker, 2006). Bar-Yosef (2012) compares the shift from foraging to farming at the Pleistocene–Holocene transition in the Levant and China, and Fuller and Rowlands (2011) discuss long term differences in East and West Eurasian culinary traditions, including differences in Late Pleistocene and Early Holocene food choices and culinary technologies, such as pottery and grinding stones. Kuzmin (2013b) is concerned with the spatial distribution and timing of the origins of pottery and agriculture in Asia, discussing two trajectories: the ‘Levantine’ with agriculture occurring before pottery, and the ‘East Asian’ that sees pottery developing before agriculture. Chapters in Yasuda (2002) consider the origins of agriculture and pottery in Southwest and East Asia, though with an emphasis on the latter region. Vandiver (1988), Zhushchikhovskaya (2012) and Gibbs (2015) all compare early pottery technology in Southwest Asia and East Asia.

2. Defining the Neolithic

Our point of departure is Childe’s (1951) list of defining features of the Neolithic. For Childe, the Neolithic comprised: (1) an agricultural economy including domesticated animals and plants; (2) population growth; (3) storage of surplus; (4) sedentism; (5) trade networks focused on nonessential items; (6) decentralized social mechanisms for the coordination of collective activities; (7) magico-religious traditions that focus on the promotion of fertility; (8) ground stone implements; (9) pottery; and (10) weaving implements such as spindle whorls. While seven decades of

archaeological advances have revised many of the empirical details outlined by Childe, his checklist remains influential (Zeder, 2009).

In this paper we are focusing on arguably the three primary features from Childe's list: agriculture, pottery and sedentism. There are two reasons for our selective approach. As noted above, pottery and agriculture are given primary importance in different definitions of the Neolithic in East and Southwest Asia, while sedentism is often cited as a necessary condition for both agriculture and pottery production. Furthermore, there is sufficient empirical evidence from both regions of interest to enable us to compare these three features. In the future, as more evidence for other aspects of the Neolithic is produced, it would be valuable to undertake a more comprehensive comparative study of the Neolithic that incorporates a fuller list of Childe's features and other attributes that have been associated with Neolithization (e.g. changes in social organization, symbolism).

It should be noted that we have not provided strict definitions of agriculture, sedentism and pottery. As will be discussed below, each of these was likely a long and complex process making definitions difficult to pin down. However, as a point of departure, we provide some working definitions here. In broad terms, agriculture has to do with planting and managing crops and sometimes rearing animals rather than relying on hunting free-roaming wild animals and gathering wild plants. Sedentism involves residing in permanent settlements while pottery refers to containers made out of fired clay. But each of these innovations has a more nuanced history, particularly when viewed over their long-term development. Does agriculture begin when people first start managing wild stands of plants and/or controlling the movement of wild animals? Or does it require the management of species with certain morphological characteristics? How should transitional economies that include both domesticated and wild species be defined, and when does one become the other, for example hunter-gatherers using a small number of domesticates versus farmers still gathering some wild plants? There are similar debates on the topic of sedentism. Precisely how much time does a community need to reside in one place to be considered sedentary? For these reasons some authors have suggested stages of "pre-domestication cultivation" and "semi-sedentism". Even defining pottery may not be straightforward. As Rice (1999) notes, some regions have evidence of a "software horizon" consisting of unfired or low-fired clay objects. Should the makers of this material be considered pottery producers? Rather than begin with particular definitions, in this paper we accept the complexities of agriculture, sedentism and pottery and examine them as processes that unfolded over time.

2.1. Neolithic developments: East Asia

2.1.1. Pottery

In the archaeology of East Asia, pottery is considered an important technological development. In the Russian Far East the appearance of pottery marks the beginning of the Neolithic period (Kuzmin, 2014). Likewise, in China pottery is considered to be an indicator of the Neolithic (Zhang and Hsiao-chun, 2008: table 1), although some recent publications have described pottery as a Late Palaeolithic or 'transitional' technology (e.g. Wu and Zhao, 2003; Bar-Yosef and Wang, 2012; Liu and Chen, 2012). In Japan, early pottery is typically considered a characteristic of the Jomon period, which is sometimes considered a 'Neolithic' culture (Habu, 2004: 243). In most parts of East Asia agriculture appeared later than the first emergence of pottery.

Pottery older than about 10,000 years has been recovered from a number of areas in East Asia, notably southern China, the Amur River, and Japan. Currently the earliest dates for pottery come from cave sites in southern China. A recent re-examination of the dating

and stratigraphy from Xianrendong Cave suggests a date of around 20,000 cal BP for pottery at the site (Wu et al., 2012), although some have questioned the validity of this early date (e.g. Kuzmin, 2013a). A date of 18,000 cal BP from Yuchanyan Cave may be a potentially more reliable indicator of the age of the earliest pottery in southern China (Boaretto et al., 2009).

In Japan, the earliest pottery is attributed to the Incipient Jomon culture. Over 100 Incipient Jomon sites have so far been identified across the archipelago, from Kyushu in the south to Hokkaido in the north, and numerous radiocarbon dates are available (Keally et al., 2003). The Odai Yamomoto I site in northern Honshu has produced some of the earliest dates, around 17,000–14,000 cal BP (Nakamura et al., 2001). Dates from the Kitihara site in central Honshu are only slightly younger (Keally et al., 2003). The Taisho 3 site on Hokkaido, with pottery dated to around 15,000–13,800 cal BP, marks the northern limit of the Incipient Jomon culture (Yamahara, 2006).

In the Russian Far East early pottery has been recovered from several sites in the Amur River basin, including sites attributed to the Osipovka cultural complex. Charcoal associated with pottery has been dated to around 16,700–15,500 cal BP at the site of Khummi, 16,400–15,000 at Gasya and 15,000–14,200 at Goncharka (Keally et al., 2004), and dating of organic inclusions found in early pottery from the Gromatukha site produced radiocarbon dates of around 16,800–15,500 cal BP (Keally et al., 2004).

In each of these areas, the earliest vessels tend to be small, with little or no decoration, and low-fired. It is currently unclear whether pottery was invented in a single area, followed by dispersals to other early centers in the region, or if there were three (or more) independent inventions in East Asia. There is also debate about the function of these early vessels. They may have been used in food processing, possibly to exploit new food resources that were becoming important as a result of shifting ecological contexts during the dynamic environmental conditions of the Late Pleistocene and Early Holocene, such as shellfish or nuts (Ikawa-Smith, 1976; Kobayashi, 2004). Organic residue analysis of Incipient Jomon pottery in Japan points to the use of marine resources (Craig et al., 2013), while starch grain analysis indicates that pottery from North China dating to about 10,000 years ago was used to process acorns and grains, particularly millet (Yang et al., 2014, 2015). However, the small numbers of pots in the earliest stages of production (e.g. Keally et al., 2003) suggests a social or ritual role for these containers cannot be ruled out (e.g. Hayden, 2009).

2.1.2. Agriculture

Within China the most frequently discussed plant domesticates are rice and millet (both common and foxtail millet). Millet is generally thought to have been domesticated during the Neolithic in northern China along the Yellow River, while the origins of rice domestication have been sought in the Middle and Lower Yangtze River. Recent research has indicated a long history of wild millet use in northern China. For example, Liu et al. (2013) extracted wild millet starch from grinding stones at the site of Shizitan 14, dating to 23,000 cal BP, and at Shizitan 9 (13,800–11,600) starch from grinding stones and seeds from flotation samples indicate the presence of millet along with a number of other wild plant species (Liu et al., 2011; Bestel et al., 2014). Zhao (2014) has identified foxtail millet exhibiting morphology indicative of human selection from the Donghulin site at 10,000 cal BP and Lu et al. (2009) argue that foxtail millet was cultivated at Cishan around the same time. Liu (2015: 6) suggests these early dates may represent a phase of 'pre-domestication' cultivation by Late Pleistocene hunter-gatherers.

Rice domestication has received greater attention than millet domestication due, in part, to its enduring economic importance, although the timing of rice domestication remains a matter of some

debate (e.g. Fuller et al., 2007; Liu et al., 2007). Jiang and Liu (2006) argue that 10,000 year old pottery from the Shangshan site in the Yangtze basin was tempered with domesticated rice husks. Rice spikelets from the Kuahuqiao site (8200–7200 cal BP) have been interpreted as deriving from a mix of wild and domesticated plants (Liu et al., 2007). Farther north, outside the Yangtze basin, the Jiahu site has produced rice grains interpreted as morphologically domesticated and dated as early as 9000 cal BP (Liu et al., 2007; Zhao, 2011; Zhang and Hsiao-chun, 2013). Zhang and Hsiao-chun (2013) interpret the Jiahu evidence as the result of influence or migration from more southerly populations who presumably were already cultivating rice. Fuller et al. (2007, 2009), however, argue that these early examples of rice may actually derive from wild populations. They see a long phase of pre-domestication cultivation of rice, with full domestication perhaps only appearing around 6500 cal BP and in the Lower Yangtze maybe not becoming a dominant part of the diet until the emergence of the Liangzhu culture (5200–4300 cal BP; Fuller et al., 2009).

While much discussion of plant cultivation and domestication in China, and northeast Asia more generally, is focused on grains, it is worth noting that other plants also likely played important roles in the diet. In particular, roots and tubers may have had a long history of use and, perhaps, even early domestication but they have less frequently been identified in the archaeological record (Crawford, 2006:81), likely due to poorer preservation. However, Zhao (2011) notes the recovery of abundant charred roots and tubers from the Zengpiyan site and suggests that the most southern China may have been a locus for the domestication of roots and tubers. However, recent analyses of starch grains demonstrates a long history of root and tuber use in northern China as well (Liu, 2015; Liu et al., 2015).

The Jomon of Japan are typically described as hunter-gatherers and have not figured prominently in discussions related to the origins of agriculture. Discussions of early agriculture in Japan often start with the advent of wet rice farming, which was introduced to the archipelago from mainland Asia during the first millennium BC. However, as Crawford (2008) points out, the emphasis on rice obscures the long history of intensive plant exploitation by the Jomon that likely included the cultivation of numerous wild species of plants. The list of species exploited by the Jomon is long, including bottle neck gourd, shiso, beans, burdock, barnyard grass, goosefoot, buckwheat, rapeseed, hemp, yam and adzuki (Matsui and Kanehara, 2006; Crawford, 2011). Crawford (1983) notes that in northeastern Japan barnyard grass increased in size over several millennia indicating that selection was taking place. The abundance of chestnut, horse chestnut and walnut on Jomon sites suggests that nut trees were managed, likely involving the clearance of surrounding natural forests to encourage the growth and yields of useful trees (Matsui and Kanehara, 2006; Crawford, 2011). Potentially cultivated plants have been found on sites dating to the Initial Jomon period, for example barnyard grass was found at the Nakano B locality on Hokkaido dating to roughly 9000–8700 cal BP (Crawford, 1983) and a variety of potentially cultivated plants was recovered at Awazu dating to earlier than 9000 cal BP (Matsui and Kanehara, 2006). Small amounts of millet and rice have been recovered from Middle Jomon sites after 5000 cal BP (Matsui and Kanehara, 2006:271).

Evidence for plant domestication in the Russian Far East is limited. Plant cultivation in Primorye has been dated to the Late Neolithic Zaisanovskaya culture (approximately 6100–3900 cal BP; Kuzmin et al., 1994, 1998). Radiocarbon dates suggest that cereal cultivation began around 5300 cal BP (Kuzmin et al., 1998, 2009: table 1). The first agriculture in the Amur River was probably somewhat later, around 3200 cal BP (Kuzmin, 2013b: table 1).

2.1.3. Sedentism

The first pottery producers in Japan were likely residentially mobile (Habu, 2004:248). The transition to a more sedentary lifestyle occurred later and was not uniform across the archipelago. Southern Kyushu seems to have developed relatively permanent sites earlier than the rest of Japan. Pearson (2006) suggests, for example, that some Incipient Jomon sites in southern Kyushu, such as Sojiyama and Kakoinohara, were occupied on a seasonal basis, while the Initial Jomon site of Kakuriyama may have been occupied year round (around 9800 cal BP). In other parts of Japan, though, even in later periods fully sedentary settlements may not have been the norm. Habu's (2001) detailed study of lithics, site size and site location in Early Jomon Moroiso-phase (approximately 5900 cal BP) Kanto and Chubu, Honshu Island, point to the presence of seasonally mobile collectors with southwestern Kanto perhaps occupied by even more mobile foragers.

There has been less discussion of the mobility patterns of the earliest pottery producers in China or the Russian Far East. Qu et al. (2013:54) suggest that early pottery producers in China and elsewhere in East Asia may have been 'semi-sedentary' with some sites being occupied on a seasonable basis. Liu and Chen (2012:70–71) state that 'high degrees of sedentism' emerged in some parts of China in the early Holocene, several millennia after the first pottery in the region. Popov et al. (2014) suggest that in Primorye seasonal sedentism may have increased during the Middle Holocene due to favorable environmental conditions and changing relationships with the landscape, as evidenced by excavations at sites like Boismen 2.

2.2. Neolithic developments: Near East

2.2.1. Sedentism

In Southwest Asia a case has been made for sedentary sites appearing during the Early Natufian (Late Epipalaeolithic) period (15,000–13,000 cal BP; Belfer-Cohen and Bar-Yosef, 2000), particularly in the central and southern Levant where Belfer-Cohen and Bar-Yosef (2000) envision a 'Natufian homeland', although the site of Abu Hureyra on the upper Euphrates River has also been interpreted as a sedentary site (Moore et al., 2000). Various categories have been interpreted as evidence for Natufian sedentism, including storage pits, cemeteries, large objects such as stone mortars, the presence of commensal faunal species, and the presence of plant and animal remains spanning multiple seasons (e.g. Belfer-Cohen and Bar-Yosef, 2000; cf.; Boyd, 2006). In contrast to preceding periods, some Early Natufian sites have evidence of fairly substantial stone structures, which have also been interpreted as evidence for permanent occupations. For example, the largest structure at the site of Mallaha (Eynan) had a diameter of about 15 m (Valla, 1988).

2.2.2. Agriculture

Much has been written about the origins of agriculture in Southwest Asia (see references in Bar-Yosef and Meadows, 1995; Zeder, 2011). In the 1980s and early 1990s the southern Levant was viewed as a core area where the first steps towards domestication occurred (Bar-Yosef and Meadows, 1995) but by the late 1990s increasing evidence shifted focus towards the upper Tigris and Euphrates rivers (Lev-Yadun et al., 2000). Several important plant and animal species were first domesticated in Southwest Asia, including wheat, barley, cattle, sheep, goats and pigs.

Some management of plant species may have occurred during the Southwest Asian Epipalaeolithic by increasingly sedentary hunter-gatherers. Snir et al. (2015) argue that evidence from the Ohalo II site points to small-scale cultivation at 23,000 cal BP. This evidence includes a sickle blade with polish derived from cutting

plants, and abundant charred seeds and fruits from wild species, including a number of ‘proto-weeds’. The degree of plant management or cultivation during the Late Epipalaeolithic is a matter of debate, particularly the importance of wild species that were later domesticated (Asouti and Fuller, 2012). It was likely not until the Early (Pre-Pottery) Neolithic (11,700–8500 cal BP) that morphologically domesticated species first appeared in the region and, indeed, wild species likely remained important throughout the earliest stage of the Neolithic (the PPNa) and it was probably not until the middle part of the PPNB (around 10,000–9300 cal BP) that domesticated plant and animals came to dominate subsistence strategies (Kuijt and Goring-Morris, 2002; Asouti and Fuller, 2013).

2.2.3. Pottery

Small amounts of pottery have been recovered from Pre-Pottery Neolithic contexts in Southwest Asia. For example, excavations at the site of Kfar HaHoresh in the southern Levant recovered 23 pottery sherds from secure PPNB contexts, ranging in date from the Early PPNB to the Late PPNB (around 10,500–8800 cal BP; Biton et al., 2014). At the other end of the Fertile Crescent, excavations at the site of Ganj Dareh produced evidence for clay vessels, probably dating to around 10,000–9800 cal BP (Smith, 1976, 1978; Zeder and Hesse, 2000). While some of the Ganj Dareh vessels were likely sun-baked pots that were unintentionally hardened during a fire that destroyed the site, Smith (1976) suggests that some of the smaller vessels may have been intentionally fired in hearths or simple kilns.

The use of pottery in Southwest Asia became widespread at the start of the Late (or Pottery) Neolithic, around or shortly after 9000 cal BP. Early pottery has been found at a number of sites stretching from Central Anatolia, across Upper Mesopotamia, to the Zagros (Moore, 1995). In the southern Levant, despite the early evidence for pottery at Kfar HaHoresh, pottery does not become widespread until the start of the Yarmoukian period, around 8500 cal BP (Banning, 2007), and in some desert areas, perhaps substantially later. As in East Asia, the function of early pottery in Southwest Asia is a matter of some debate. Some of the earliest pots at Tell Sabi Abyad are decorated (Nieuwenhuys et al., 2010), which may indicate a role other than purely utilitarian, although other undecorated pots may have had a more quotidian functions as storage or cooking pots. Unfortunately, the small numbers of the very earliest ‘Pre-Pottery’ pots have not been extensively described or discussed in the literature.

3. Discussion

Not surprisingly, there are some clear differences between Neolithization in East Asia and Southwest Asia, such as the species that were available for domestication and the foods cooked or served in pottery (e.g. Gregg et al., 2009; Craig et al., 2013). More interesting, perhaps, are the broad similarities that a comparative approach can lend to general discussions of the Neolithic. In particular, evidence from both East Asia and Southwest Asia indicate that some of Childe’s enduring concepts may need to be re-evaluated, namely (1) the idea of a Neolithic package comprised of a suite of key features that developed and diffused together, and (2) the idea of the Neolithic as a revolutionary event, that occurred rapidly with (3) obvious benefits and irreversible consequences (see also Finlayson, 2013).

3.1. Neolithic Package

In each of the two areas under investigation it is becoming increasingly clear that key developments associated with the

Neolithic, such as agriculture, pottery and sedentary sites, developed at different times, rather than emerging more or less simultaneously as a complete Neolithic Package (Fig. 2). In Southwest Asia, Childe’s suite of Neolithic characteristics does not appear as a fully developed package until the end of the Neolithic and, indeed, the domestication process likely continued beyond the end of the traditionally-defined Neolithic with some key plants and animals probably not being domesticated until the subsequent Chalcolithic or Early Bronze Age periods, notably donkey and olive. Moreover, the ‘secondary products’ of some important domesticated animals, such as cows’ milk and sheeps’ wool, were likely not bred for until later in the Neolithic or during subsequent periods (Finlayson, 2013). In Japan, a full Neolithic package, consisting of grain-based agriculture arguably did not appear until the post-Jomon period.

Comparing Neolithization in East Asia and Southwest Asia demonstrates that the order in which key developments appeared is variable. In East Asia, pottery technology develops first with sedentary sites and agriculture appearing millennia later. In Southwest Asia, sedentism is the first of the developments discussed here to emerge, followed by agriculture and then pottery. This suggests that particular Neolithic features are not necessarily contingent on pre-existing developments and that Neolithization can unfold in different ways. Notably, in East Asia, pottery was not contingent on the existence of sedentary sites. Residential mobility has been identified as incompatible with pottery production for a number of reasons (Arnold, 1985): mobile groups may have scheduling conflicts that preclude them from making pottery during optimal times of the year (i.e. warm and dry seasons); mobile groups may not remain in one location long enough to undertake pottery production; when compared to other containers, pottery is heavy and breakable and therefore not convenient to transport during residential moves; and pottery production may not be useful for small, mobile groups that do not need large amounts of durable containers. Nevertheless, in East Asia it seems that the first pottery was produced by relatively mobile groups and we should conclude that pottery was not dependent on the earlier development of sedentary living. It is possible that in some areas, the invention of pottery encouraged a more sedentary lifestyle. However, there are other ways that groups can resolve conflicts associated with pottery production and a mobile lifestyle, such as caching vessels, designing vessels

Fig. 2. Approximate dates for three developments commonly associated with the transition to the Neolithic in East Asia and Southwest Asia. Note the different dates and order of the developments in the two regions. Temperature curve is from the GISP2 core (Johnsen et al., 2001).

with mobility in mind, or even making relatively disposable pottery (Gibbs, 2012).

Sedentism has also been identified as a prerequisite for the emergence of agriculture and, indeed, in both East Asia and Southwest Asia there is evidence to suggest that sedentary sites preceded the first appearance of farming. In particular, the Natufians of Southwest Asia and the Jomon of Japan are often described as complex hunter-gatherers with relatively permanent sites. However, the case for Natufian sedentism may have been somewhat overstated (Finlayson, 2013:137) and not all Natufian sites show evidence for permanent occupations. Belfer-Cohen and Bar-Yosef (2000:21) point to a dichotomy between larger sedentary sites and smaller sites that have been interpreted as less permanent 'ephemeral camps' that are usually located in marginal environments. Hardy-Smith and Edwards (2004) suggest that a straightforward dichotomization of sedentary and mobile may be overly simplistic and that refuse disposal activities at large Natufian sites were incompatible with full sedentary living, while Boyd (2006) argues that the traditional concept of sedentism may not be nuanced enough to characterize the Natufian evidence. If sedentary living did not become wholly entrenched during the Natufian then it is conceivable that some Neolithic communities, even agricultural ones, may have retained a degree of mobility. However, as Finlayson notes "The belief that sedentism is part of the [agricultural] Neolithic is so secure that the nature of Neolithic sedentism is barely discussed" (Finlayson, 2013:137).

Discarding untested assumptions about the nature of Neolithic settlements could call into question the strict correlation between agriculture and sedentism. In Japan, the Jomon may have been cultivating plants on a limited basis as early as the Initial or Early Jomon period. In southern Kyushu, sedentary sites may have appeared prior to this time (Pearson, 2006) but this pattern is not uniform across the archipelago and, certainly, the nature of early sedentism in Japan was as complex and varied as sedentism in Southwest Asia. As noted above, Habu (2004) argues that some sites do not display evidence for fully sedentary living in the latter part of the Early Jomon or even in the Middle Jomon but also stresses the probability of significant variation in Jomon settlement patterns at this time. Although more work is needed to understand the origins of sedentism in both Southwest Asia and East Asia, it seems possible that the relationship between sedentary sites and agricultural or horticultural economies was complex and not one of straightforward correlation.

As outlined above, various developments associated with the Neolithic may not have appeared together as a package and particular features may not always be contingent on earlier developments. The general timing of Neolithization in both regions—during the Late Pleistocene and Early Holocene—may suggest a relationship between cultural change and environmental changes that were occurring during this time. Testing the association between cultural and environmental change will require extensive dating and the detailed examination of palaeoclimatic data. In Southwest Asia, Maher et al. (2011) have shown that clear temporal correlations between cultural and environmental changes are difficult to support, and any relationships between climatic events such as the onset of the Bølling-Allerød, Holocene or 8.2 ka events and cultural developments, such as the appearance of sedentism, agriculture and pottery, were likely rather complex. Similarly, in East Asia it may turn out to be difficult to correlate particular cultural developments with climatic changes. Notably, counter to expectations, the earliest pottery in the region appears to date to a colder phase at the end of the Ice Age and prior to the onset of the Bølling-Allerød warming phase.

3.2. A Neolithic revolution?

Based on these insights, we re-visit a related issue: the description of the Neolithic as a revolutionary event that happened over a relatively short time. Looking at the dating evidence for the developments discussed here shows that Neolithization unfolded over a rather long period of time. In East Asia, pottery began as early as 18–20 thousand years ago, with sedentary sites—even seasonally sedentary ones—probably not appearing until after the onset of the Holocene. Likewise, the earliest agriculture in China likely dates to sometime after 10,000 cal BP. In the adjacent regions of Japan and the Russian Far East, agriculture appears even later. In Southwest Asia, some degree of sedentism likely appeared during the Early Natufian, with agriculture and pottery appearing millennia later. In fact, Finlayson (2013:139) suggests the Southwest Asian Neolithic may have taken as much 8000 years to develop.

It is also worth noting that when considered individually, each of the three developments discussed here exhibits a relatively long period of development. In Japan, for example, pottery may have appeared by 16,500 years ago but it was not produced in large numbers until after the onset of the Holocene, around 11,200 cal BP (Keally et al., 2003). There was also a long period of development of pottery technology in Southwest Asia, from the earliest 'Pre-Pottery' pots to the widespread adoption of the technology sometime around or shortly after 9000 years ago. Likewise, as Crawford notes, there was a potentially millennia-long period of Jomon cultivation of plants before rice-based agriculture became the basis of Yayoi subsistence at the end of the first millennium BC. In Southwest Asia, agriculture developed over the course of millennia, with hunting and gathering probably remaining relatively important until after the end of the Pre-Pottery Neolithic.

Acknowledging the drawn out development of different Neolithic features makes identifying a starting point for the earliest stages of Neolithization rather difficult. Do we start at the first hints of a particular development, for example, when the first few pottery sherds were produced in East Asia? Or when the technology becomes commonplace? In the case of domestication this is particularly important since the earliest stages of the process—the changes in human and animal behaviour that led to morphological changes in plants and animals—may have left little archaeological evidence. Zeder (2011:S20) points out that these morphological changes may have occurred only late in the domestication process and that a mix of domesticated, managed and free-living wild species may have persisted in Southwest Asia for 4000 years or more before the establishment of subsistence strategies based primarily on domesticated plants and animals. Some developments, notably sedentism, may have had rocky starts, with early attempts at sedentary sites being abandoned for a renewed mobile lifestyle, which may have occurred during the Late Natufian in Southwest Asia. How we define the Neolithic will certainly impact our understanding of when it began. Approaching the Neolithic as if it were an abrupt event obscures the long development of Neolithization, which unfolded over millennia (e.g. Zeder, 2009 fig. 3). As Finlayson (2013: 139) notes: "If history really begins with the Neolithic, more than half of human history is taken up with the revolution!"

3.3. Impact of the Neolithic

Another implication of thinking about Neolithization in revolutionary terms is that it had obvious and lasting effects. While the influence of the Neolithic on the modern world is undeniable, the impact that it had on the people who experienced it cannot be assumed. The long time it took for the Neolithic to take hold in both East Asia and Southwest Asia demonstrates the continued viability

of other economic, settlement and technological strategies, even when pottery, sedentism and agriculture were viable options. In both regions, hunting and gathering likely persisted alongside early stages of agriculture, pottery may not have uniformly replaced other container technologies, and some communities likely retained a relatively high degree of residential mobility, such as herders in Southwest Asia and foragers in parts of Honshu, Japan.

Archaeological evidence also indicates spatial variability within each of the regions being discussed here. If the benefits of Neolithization were immediately obvious to people living during the process we might expect a more rapid and uniform adoption of a Neolithic way of life. Yet [Zhang and Hsiao-chun \(2012\)](#) report that in southern China communities of hunter-fisher-gatherers persisted despite the presence of rice farming in neighbouring regions, with whom they shared many other attributes. Indeed, some farmers migrating to the Xia-Jiang region may have even given up agriculture and adopted a hunter-gatherer lifestyle. In East Asia, there are also regions that lack clear evidence for a very early (i.e. Pleistocene) adoption of pottery despite being in proximity to early centers of pottery innovation, notably Korea and Primorye where pottery first appears several millennia after the earliest centers of innovation. In Southwest Asia, as noted above, sedentism may not have been uniformly embraced during the Natufian and some parts of the region did not develop a reliance on pottery use for centuries despite having probably contacts with early adopters. Notably, in the southern Levant, despite very early experiments with pottery production and early plaster technology ([Kingery et al., 1988](#); [Biton et al., 2014](#)), pottery does not become widespread until about 8500 years ago, several centuries later than in the northern Levant and Upper Mesopotamia. This level of Neolithic variation may exist in other parts of Eurasia as well, for example, in Neolithic Britain (e.g. [Thomas, 1999](#)).

Some of the regional variations observed may be related to environmental variations within each region. The late adoption of agriculture in desert regions of Southwest Asia is an example. In other cases, however, archaeologists need to be open to the possibility that cultural choices were made to not adopt pottery, farming or sedentary living. From the perspective of the 21st century, these choices may seem unreasonable but other strategies may have seemed more viable to the people experiencing the Neolithic. The eventual success of the Neolithic was likely not obvious at the time.

The perceived impact of specific Neolithic developments has possibly impacted the direction that archaeological research has taken. For example, as [Crawford \(2008\)](#) notes, in Japan the equation of agriculture with rice farming has led to the disregard of a potentially long period of Jomon cultivation. In Southwest Asia, until recently there has been relatively little interest in the very earliest stages of Pre-Pottery Neolithic pottery production with some key assemblages remaining unpublished or incompletely published. More emphasis seems to be placed on the later wide-scale adoption of pottery in the region sometime after 9000 years ago. This could be due to the perception that small amounts of very early pottery would have had little impact on sedentary Near Eastern societies that were already practicing farming. Only when pottery became abundant in later periods would it have a greater impact. In East Asia the very earliest stages of Late Pleistocene pottery production has seen greater interest, perhaps because small amounts of pottery are thought to have had a greater transformative impact on mobile hunter-gatherers than sedentary farmers.

4. Conclusion

As an object of study, the Neolithic continues to play a central role in the archaeology of Eurasia as both a kind of definitive period,

but also as a transformative process. Clearly, there are two broadly contrasting patterns in East and West Eurasia (see also [Kuzmin, 2013b](#)). Comparative approaches facilitate better definitions and better understandings of these two Neolithization trajectories by highlighting general similarities and specific differences between regions. In both East Asia and Southwest Asia it is becoming increasingly clear that descriptions of the Neolithic that focus on a package of traits that developed simultaneously and had clear, revolutionary consequences need to be reconsidered. Three features of the Neolithic—pottery, sedentism and agriculture—seem to have developed independently in both regions and over relatively long spans of time. In some parts of the world, such as Europe, there is more evidence that a suite of Neolithic traits spread together but in other regions this needs to be tested rather than assumed. Likewise, archaeologists need to investigate whether the benefits of transitioning to a Neolithic way of life would have been obvious to people living during processes of Neolithization and we need to consider what other choices people could have made.

In this paper we focus on the origins of just three of Childe's components of the Neolithic package and in just two regions of the world. Certainly, examining other features from a comparative perspective would be interesting, including the very early appearance and use of groundstone implements and changes in symbolic and ritual behaviour. Future studies should also focus on other geographic areas, such as North Africa where early steps towards Neolithization are also seen. A comparative approach can also contribute to discussions of how Neolithic characteristics dispersed into new areas, either independently or as part of a package, by framing the study of dispersals in terms of the sequence and content of developments in each source region. This can facilitate the study of farming dispersals from West Asia, for example into Northwestern Europe, but also the dispersal of pottery traditions out of East Asia, for example, across Siberia and into the farthest reaches of Northeast Asia and eventually Alaska.

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