Final authors' manuscript. Published version in *Language Dynamics and Change*, Volume 7, Issue 2, pages 152-186 (2017)
DOI: 10.1163/22105832-00702001

The spread of agriculture in eastern Asia: Archaeological bases for hypothetical farmer/language dispersals

Abstract

Millets and rice were important for the demographic history of China. This review draws on current archaeobotanical evidence for rice and millets across China, Korea, eastern Russia, Taiwan, Mainland southeast Asia, and Japan, taking a critical approach to dating evidence, evidence for cultivation, and morphological domestication. There is no evidence to suggest that millets and rice were domesticated simultaneously within a single region. Instead 5 regions of north China are candidates for independent early cultivation of millets that led to domestication, and 3 regions of the Yangtze basin are candidates for separate rice domestication trajectories. The integration of rice and millet into a single agricultural system took place ca. 4000 BC, and after this the spread of agricultural systems and population growth are in evidence. The most striking evidence for agricultural dispersal and population growth took place between 3000 and 2500 BC, which has implications for major language dispersals.

1 Introduction

The origins and spread of millets and rice, the major staples of ancient China, have implications regarding the development and spread of cultures, language groups and ethnic groups across eastern Asia (Bellwood, 2005; Blench, 2005; Sagart, 2008; Robbeets, 2015). While wet rice agriculture is arguably the most productive form of landuse and has supported dense and growing populations (e.g., Ellis and Wang, 1997), it was millet agriculture that underpinned the rise of the Chinese state in the Yellow River (Liu and Chen, 2012) and is therefore equally significant for studies of past demography. This paper reviews the evidence for the early cultivation, domestication and spread of Chinese millets and rice agriculture from ca. 7000 to 2000 BC. The review is based on the empirical archaeobotanical evidence for plants preserved on archaeological sites, usually by charring; but other plant remains, less diagnostic of domestication, e.g. phytoliths and starch grains, and artefacts indicative of probable cultivation and harvesting activities are also considered. The review draws upon the Asian Crops Archaeobotanical Database (AsCAD, Stevens et al., 2016), expanded from an existing Rice Archaeological Database (Fuller et al., 2011; Silva et al., 2015). A critical approach to dating has been taken and spurious, untrustworthy radiocarbon dates have been rejected. The half-life has been standardized to 5568 before calibration (Stuiver, 1982), as many dates from China reported in the 1980s and 1990s assumed a half-life of 5730, and this has sometimes resulted in miscalibrations in the literature (Lu, 1999: 9). Where radiocarbon dates are not available, dating has been proposed by cultural association to a cultural phase, with a critical approach taken to the radiocarbon dating of that phase on other sites.

There can be no doubt that agriculture, in most instances, supports higher population densities and rates of population growth than foraging. This has led to the observation that agriculture was more or less a necessary requisite for cultural traditions that have survived into the later Holocene (with the exception of extremely marginal environments) (Richardson et al., 2001), and that most linguistic diversity derives from language lineages that were spoken and spread by early farmers (Bellwood, 2005). Binford (1968) introduced the idea that the transition to farming was part of a related set of post-Pleistocene adaptations, in which humans adapted to richer biotic environments and increased demographic pressure through the exploitation of a wider range of lower-value resources, including the ancestors of seed crops, and ultimately agriculture. What has become clear through recent empirical evidence, however, is that the initiation of cultivation occurred much earlier than the domestication of crops and, in its early stage, was disconnected from true agricultural subsistence, in which domesticated taxa came to dominate caloric subsistence (Asouti and Fuller, 2013; Fuller et al., 2014; Maeda et al., 2016). A key implication is that, contrary to the notion of a single rapid Neolithic demographic transition, which has tended to be dated by conflating the start of cultivation and eventual domestication (e.g., Guerrero et al., 2008; Bocquet-Appel, 2011), there rather was a protracted series of developments in the Neolithic that culminated in agriculture, which in turn supported much larger populations. In the current contribution, we decouple the start of cultivation from the transition to major food surpluses that is implied by reliance on agriculture and domesticates. While incipient cultivation undoubtedly supported higher sedentism and some population increase over pure foraging, it was the transition to an agricultural economy and the establishment of true domesticated crops that is likely connected to unprecedented population increase.

The widely discussed language-farming dispersal hypothesis rests on the premise that increased population densities within early farming societies lead to emigration in search of new land for agriculture and settlement, which simultaneously dispersed various languages (Bellwood and Renfrew, 2003; Bellwood, 2005). Over time this led to the distribution of related languages, ultimately the language families of farmers, over wide regions. Robbeets (2015, this volume) argues that the expansion of Transeurasian languages, including the ancestors of Japonic and Koreanic languages, arose from *Panicum miliaceum*-based agricultural societies that developed in northeast China. Meanwhile, speakers of languages ancestral to Old Chinese are inferred to have been present in the Yellow River Valley cultivating millets, especially *Setaria italica,* and some rice. On the basis of similarities in culture and ancestral shared vocabulary for *S. italica* and rice, Sagart (2008; 2011) has suggested that the origins of Austronesian, which dispersed to Taiwan from the East Asian mainland, lie within or near the Shandong peninsula, rather than the Lower Yangtze Region as postulated by Bellwood (2005). Both Hmong-mien and Austroasiatic have been suggested to be connected to rice origins and dispersal from the Yangtze basin (e.g., Bellwood, 2005; Sagart, 2011), but there has been little detailed correlation of the linguistic and archaeobotanical evidence.

2 Method and philosophy: A critical archaeobotany of domestication and early agriculture

The primary approach represented by this paper is a critical assessment of current archaeobotanical evidence, alongside complementary artefactual evidence of cultivation-related tools. This is not a restatement of commonly held opinions on the Chinese Neolithic, in particular with regards to pre-Yangshao cultures, before 5000 BC. All of these Early Neolithic cultures, which we deal with in this paper, traditionally tend to be regarded as early farming societies (e.g., Liu and Chen, 2012; Underhill, 2013; Shelach and Teng, 2013 and see primary references in Tables S1–S4), but this relies on assigning them agricultural economies more on assertion and assumption rather than on empirical evidence. That such sites were bigger and have more investment in house structures than earlier sites is clear, but this shift towards increased sedentism does not prove year-round occupied villages, nor does it make them farming settlements comparable to those which followed – except by imposing outmoded ethnographic models on the diversity of the pre-agricultural world (see Asouti and Fuller, 2013 for a similar critical perspective on the Near East). Much of this stems from the tendency to equate the presence of domesticated crops, or more precisely, plants undergoing domestication, with fully agricultural societies. This is a recurring problem in many parts of the world and in discussions of agricultural origins (Zeder, 2015; Smith, 2015).

We take as our baseline the clear definitions of cultivation, domestication (a genetic status of a crop), and agriculture from Harris (1989; see more recently Asouti and Fuller, 2013; Harris and Fuller, 2014). Cultivation is seen as an activity of soil preparation, sowing, and harvesting, and in its broadest sense has been widely practiced by many hunter-gatherer societies throughout the Holocene and before, in the sense of *niche construction* (Smith, 2015; Fuller et al., 2014). Agriculture, in contrast, is about economic dependence, encompassing a predominant reliance on cultivation – usually centered on species that are domesticated, e.g. changed genetically from their wild ancestors. Smith (2001) suggests that agriculture means that more than 50% of calories come from cultivated resources, and while precise estimates of past diets are always a challenge, this remains a useful rule of thumb. Taking southwest Asian evidence as an example, the earliest cultivation was established across several sub-regions between 9500 and 9000 BC (if not earlier), but at that period no crops show morphological domestication traits. These do not rise to dominance until after 8000 BC, only becoming fixed in wheat and barley around or after 7000 BC (Fuller et al., 2014). Sites that have produced quantified archaeobotanical assemblages comprising more than 50% cereals do occasionally appear in the Levant by 9000 BC, but on the whole, most early cultivating sites had plant economies dominated by wild foods, with cereal-dominated assemblages only becoming the norm from 7000 BC (Maeda et al., 2016). For the Near East, it is clear that the transition from early cultivation through domestication and agriculture took in excess of 2000 years. Our aim in synthesizing the evidence for China has been to look critically at the available archaeobotanical data and dating. As was the case in the Near East, we have assumed that the transition from early cultivation to agriculture took a minimum of 2000 years, perhaps longer, and the largest demographic increase came at the end of this process. The interpretations presented below follow this reasoning, and to avoid excessive repletion, we will not continually note where this differs from orthodox treatments of Chinese prehistory.

The pre-domestication cultivation stage represents the transition from the gathering of food plants to preparing the soil and sowing them. Initially these plants are morphologically wild, but during this period, genetic and morphological changes occur which “adapt” the plant to the cultivation regime. These biological changes are defined as domestication. A recent synthesis of many major crops from around the world allowed the start and finish of domestication to be mapped comparatively across species (Fuller et al., 2014). For cereals, this study demonstrated two significant results. Firstly, it showed that domestication occurs over extremely protracted periods of time, ranging from 1500 to over 3000 years. Secondly, it confirmed that grain size increased concurrently with changes in shattering, the transition from wild grain dispersal to reliance on human planting. One implication is that grain size change is a useful proxy for the domestication processes when evidence for seed dispersal is not available, as is the case for the millets. While some size increase is noted for millets from early sites (e.g. Zhao, 2004; Liu and Chen, 2012; Barton, 2009: 174–180; Crawford et al., 2016), what is needed are extended sequences demonstrating directional evolution. What these data tend to indicate, as reviewed below, is that the domestication process for millets continued well into the Yangshao period, and this suggests a need to reconsider when agricultural economies and associated demographic shifts took place.

We also differentiate phases in the spread of crops beyond their initial areas of cultivation. Initially, cultivation technologies emerged where wild cereal stands are prolific, replacing wild harvesting. A second phase sees cultivation spread, along with proto-domesticated cereals still undergoing morphological evolution, into areas within the general ecological limits of the wild ancestor, encroaching on and replacing wild cereal stands. At this stage we might expect increasing human population density. The final stage is the spread of fully domesticated crops, along with cultivation technologies, into areas where wild stands were absent or not widespread enough to have formed a major seasonal staple. This third stage is that posited to have spread the language families of early farmers.

3 Centers of cultivation and domestication of millets

Two species of millet were domesticated in China. Foxtail millet, *Setaria italica,* descended from *Setaria viridis,* is widespread throughout northern/central China, Central Asia and Europe, but appears to have been domesticated in China (Eda et al., 2013). *Panicum miliaceum* was also domesticated within northern China, but the wild progenitor is disputed, although *Panicum miliaceum* subsp. *ruderale* represents one possibility (De Wet, 2000).

Given the general absence of charred archaeobotanical evidence before 6500 BC, the longevity of millet consumption is currently based on conjecture. Shizitan, Shanxi, dated from 12,000 to 9,600 BC, is one of the few sites where charred grains have been identified, along with millet starch associated with grinding stones (Bestel et al., 2014). The use of millets between 9000-7000 BC is also affirmed through millet starch from grindstones at Nanzhuangtou, Hebei and Donghulin (Yang et al., 2012a; 2015). They appear dominated by *Setaria* or *S. italica*-like starch, but given current limitations on reference collections (Yang et al., 2012b), these cannot be accepted as definitive evidence for cultivation or domestication.

Based upon current archaeological evidence, five "centers" of millet cultivation are distinguished (A–E below; see Fig. 1 and Supplementary Materials, Table S1).

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A) Peiligang, northern Henan

The Peiligang culture (excluding Jiahu, which is regarded as peripheral) dates to the 7th millennium BC. Radiocarbon dating suggests that sites with good evidence for charred millets occur no earlier than 6500–6000 cal. BC (Liu and Chen, 2012), the earliest evidence relating predominately to reported foxtail millet (*Setaria viridis/italica*), recovered from three sites to the south of the Yellow River (Fig. 1; Table S1). While other sites in this area, between 6500 and 5000 BC, produced charred remains of wild foods – e.g. walnut, jujube, and acorns – flotation was rarely conducted, so small remains of millet are unlikely to have been recovered. However, many sites did yield evidence for cultivation in the form of sickles, spades and/or hoes (Table S1; Zhu, 2013: Table 9.1; Liu and Chen, 2012: Table 5.3).

Sedentary villages, with increased evidence of cultivation tools, subsequently developed in this region during the Early Yangshao period after 5000 BC (Zhu, 2013). A western Yangshao variant (Early Banpo) and an eastern variant (Hougang period I) are recognized. Recent archaeobotanical research shows increased grain size for *Setaria* still occurring between the Early and Late Yangshao (Zhao, 2015), suggesting that, while well-established cultivation economies were present, the evolution of domestication traits in millets was still ongoing.

B) Cishan, southern Hebei

These sites share some cultural affinities with Peiligang sites to the south, although enough differences exist for them to be culturally separated (Zhu, 2013). Currently only Niuwabao and Cishan have reported millet remains, in both cases from rectangular shafts/pits (Ren, 1996). At Cishan, both foxtail and broomcorn millet were identified from phytolith remains (Lu et al., 2009). A critical assessment of radiocarbon dates, along with cultural similarities to the Peiligang culture, places the site in the late 7th/early 6th millennium BC (e.g., Chang, 1986; Cohen, 2011; Zhang and Hung, 2013; Zhao, 2011) and therefore renders it broadly contemporary with millet cultivating sites to the south. The high levels of *de facto* refuse and caches at sites such as Beifudi, and possibly also Cishan, might also indicate some degree of seasonal mobility, perhaps associated with the collection of acorns (Liu and Chen, 2012: 137). Bettinger and colleagues (2010a) also argue that cache pits like those at Cishan are “typical” of seasonally mobile hunter-gatherers. Cishan culture can also be regarded as a precursor to the early Yangshao (Hougang period I), when sedentary farming villages became more widespread in this and the Peiligang area (Zhu, 2013, and see above).

C) Houli culture sites, West Shandong

The Houli culture sites of Yuezhuang and Xihe, near Jinan, have remains of foxtail and broomcorn millet, along with rice, between 6500 and 5000 BC (Crawford et al., 2006, 2016; Jin G. et al., 2014). Staple isotope data from Xiaojingshan, close to Xihe, indicate the consumption of millets, but demonstrate they contributed less than 25% of dietary protein (Hu, 2008). The lack of cultivation tools has also been used to argue that cereals contributed little to the diet (Liu and Chen, 2012: 140), and together with the published photographs, which do not suggest fully domesticated grain, raise questions as to the extent of cultivation/cereal management at this date. The recently reported sites of Zhangmatun, with radiocarbon dates of ca. 7000 cal. BC on wild grape pips, also produced small numbers of millet grains, but as grains of wheat occurred that must be intrusive, the security of these millets must be questioned as well (Wu W. et al., 2014).

The rice grains from these early Shandong sites are also ambiguous. Although there remains some debate over grain size criteria (Liu et al., 2007; Crawford, 2012; Gross and Zhao, 2014), there is no clear case for these grains being regarded as domesticated, and no spikelet bases have been found to assess grain shattering. The Xihe rice is indicated to be morphologically wild (Jin G. et al., 2014), and based on our current understanding of grain size change during domestication (e.g., Fuller et al., 2010, 2014; Deng et al., 2015; Castillo et al., 2016), these finds can indeed be placed at the wild end of the trajectory; hence, this rice is just as likely to be wild gathered as cultivated. Wild rice probably occurred in this region into historic times (Fuller et al., 2010), but, given the lack of continuity of rice into later periods (D’Alpoim Guedes et al., 2015), Houli is a likely dead-end trajectory in early rice cultivation and hence probably played no role in the subsequent development and early spread of rice agriculture. Given Houli rice appears to have been wild, it cannot be ruled out that millets, too, were a largely gathered resource. However, the later Beixin culture (ca. 5500–4000 BC) in Shandong does have limited evidence for millets and finds of harvest knives, and increasing settlement density, stone spades, and unambiguous sedentism dates are found for the subsequent Dawenkou culture after 4000 BC (Liu and Chen, 2012: 184).

D) Xinglongwa, Manchuria

The site of Xinglonggou in Inner Mongolia produced a few contexts with large quantities of predominately broomcorn millet and small amounts of foxtail millet, directly radiocarbon-dated to between 6200 and 5400 cal. BC (Zhao, 2011). This material is only a few centuries later than Cishan or the earlier Peiligang, but appears culturally independent. Xinglongwa, the type site for this culture, had no direct botanical evidence, but isotope analysis of the bones revealed some C^4 plant consumption by the site inhabitants, most likely millets (Zhang X. et al., 2003; Shelach and Teng, 2013). However, millets probably contributed only 15% of dietary protein, with high N^{15} values signifying consumption of hunted animals that consumed C^4 plants (Hu et al., 2008). The continued presence of cultivation tools through to Zhaobaogu (5400–4500 BC) suggests continuity of a cultivation tradition (Shelach and Teng, 2013). Xinglonggou *Panicum* grains were small (Liu and Chen, 2012: 85), consistent with an early pre-domestication cultivation stage, not domestication.

E) Dadiwan culture, Gansu

Two sites, Dadiwan and Qin'an, provided charred archaeobotanical evidence for *Panicum miliaceum* between 6000 and 5400 BC (Table S1). While Dadiwan only produced a single spade, other cultivation tools, mainly spades, are known from Baijia and Liajiacun (Liu, 2004: 150–152). Grain measurements of *Panicum miliaceum* are small, indicating grains closer to the morphologically wild end of the spectrum, including possible immature grains (Barton, 2009: 174–178). Isotopic evidence from Dadiwan suggests a C^4-rich diet for some dogs, indicating millet cultivation and the feeding of dogs on millet cooking scraps (Barton et al., 2009) and/or human feces containing millet.

While there is a case to be made for an independent start of cultivation by the Dadiwan culture in Gansu, this is plausibly a developmental dead-end. Stratigraphic excavation and radiocarbon dating indicate a hiatus in occupation at Dadiwan of a millennium or more through most of the 5th millennium BC (c. 5400–5300 BC to c. 4000 BC; Bettinger et al., 2010b). After this, the site is occupied by people of the Early Yangshao (Late Banpo type) culture, suggesting an influx of settlers from the east who cultivated both *Panicum* and *Setaria,* probably with domesticated pigs that consumed millet and human feces (Barton et al., 2009). Other Late Banpo era sites, such as Xishanping, Heituya and Gedachuan, also produced mixtures of *Panicum* and *Setaria.* Grain sizes of both millets are bigger in the later Yangshao samples from this region (Barton, 2009: 174–178; Liu and Chen, 2012: 85), indicating the domestication process was ongoing into the 4th millennium BC.

3.1 The establishment of millet agriculture: A summary

While a number of cultural zones provide candidates for the cultivation and origins of millet domestication, the establishment of agriculture only becomes evident in the late 5th millennium BC with the onset and spread of the Yangshao and Dawenkou cultural traditions along the Yellow River. Our archaeobotanical database includes around 140 sites of this period, and where quantitative data is available, millet grains dominate charred assemblages (e.g., Lee et al., 2007; Fuller and Zhang, 2007; Song, 2011). This period also witnesses the diversification of agriculture, with widespread evidence for soybean, which had begun to undergo size increase, a sign of domestication, by the mid-3rd millennium BC (Lee et al., 2011; Fuller et al., 2014), as well as plausible cultivation of *Perilla frutescens* and hemp (*Cannabis sativa*). It is also possible that some management or cultivation of fruit trees took place, like Chinese date, *Ziziphus jujuba* (cf. Fuller and Zhang, 2007), apricot and peach (Hosoya et al., 2010; Zheng et al., 2014; Weisskopf and Fuller, 2014). Pigs are also widespread across sites in this period and presumably domesticated (Yuan et al., 2002a; Flad et al., 2007; Larson et al., 2010). The integration of household pig-keeping with millet farming is indicated by carbon isotopes from pigs, such as at Dadiwan, Kanjia, Xipo and even Longshan Liangchengzhen in Shandong (e.g., Pechenkina et al., 2005; Barton et al., 2009; Lanehart et al., 2011). As we will see, domesticated rice began to be adopted into the millet-based agriculture, but even then millets remained the focus of agriculture at all well-documented sites.

4 Centers of cultivation and domestication of rice

The origins of Asian rice have received considerable archaeological and genetic attention in recent years (e.g., Fuller et al., 2010, 2016; Gross and Zhao, 2014; Castillo et al., 2016; Choi et al., 2017). In this discussion, we concern ourselves only with the origins of subspecies *japonica,* which is unambiguously domesticated from wild populations in eastern Asia. The earliest undisputed sites with remains of rice associated with cultivation can be divided into three regions: the Lower Yangtze (F), the Middle Yangtze (H) and the Lower Hanshui Valley/Upper Huai Valley (G) (Fig. 1; see Supplementary Materials, Table S2). Differences in material culture and the nature of the earliest field systems between the Middle and Lower Yangtze argue independent developments of rice cultivation (Fuller and Qin, 2009; Makibayashi, 2014). The Middle-Lower Huai River in northern Anhui/western Jiangsu and the Lower Hanshui River in southern Henan could also represent distinct centers.

F) Early rice of the Lower Yangtze and Lower Huaihe River

The evolution of domesticated rice from wild rice is archaeobotanically only well documented for the Lower Yangtze, where large assemblages of spikelet bases have been used to track the domestication process (Fuller et al., 2014). Such empirical evidence is better for the middle and later part of the process (Fuller et al., 2009, 2014; Crawford, 2012). The analysis of the proportion of wild (shattering), domestic (non-shattering) and immature rice spikelet bases from these sites over time provides a clear picture of rice domestication as a nearly linear trend of increasing grain size and increasing proportion of non-shattering spikelet bases between 6000 and 3000 BC (Fig. 2).

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The earliest dated sites with good evidence for rice use cluster around 7000 BC and are associated with the Shangshan culture (Table S2). Little evidence from macro-remains is available from these sites, so they might represent the beginnings of cultivation or still subsisted solely on gathered wild rice. However, phytolith studies (Wu

Y. et al., 2014) put Shangshan at the beginning of a trend in phytolith metrics that led to increasingly domesticated rice plants in later sites like Kuahuqiao and Tianluoshan.

The Shangshan sites were likely only seasonally occupied, with a high reliance on wild foods, but with increased sedentism seen in later phases (Liu and Chen, 2012: 63; Jiang, 2007). The ensuing Kuahuqiao culture is dated from around 6000–5400 BC, with at least some cultivation tools (ZPIACR, 2004), while rice grains and spikelet bases indicate cereals in an early stage of pre-domestication cultivation (Fuller et al., 2014). Extensive use of wild foods, notably acorns and *Trapa* water chestnuts, is similar to the subsequent Hemudu culture (Fuller and Qin, 2010). Unlike the Shangshan, Kuahuqiao appears fully sedentary (Liu and Chen, 2012: 70–72, 158–160).

By 5000 BC, the major sites of Hemudu and Tianluoshan had appeared in the Yuyao region east of Hangzhou, while the Early Majiabang culture emerged north of Hangzhou Bay. The rice spikelet bases from Tianluoshan fall near the middle of the domestication episode, with a shift to the domesticated type outnumbering the wild form around 4650 BC (Fuller et al., 2009). Majiabang and Hemudu grains were plumper than those of earlier Kuahuaqiao but yet to reach the size seen in later sites (Fuller et al., 2010; 2014). Wooden hoes and bone spades from Kuahuqiao and Hemudu were suitable for working softer wetland soils, but later were displaced by stone, suited to harder clays (Xie et al., 2015). By around 4000–3800 BC (Late Majiabang period), the percentage of domestic as opposed to wild spikelet bases at Caoxieshan reached 70–80% in some samples, representative of full domestication. Simultaneously, wild foods like acorns and *Trapa* largely dropped out of the diet from the late Majiabang era onwards (Fuller et al., 2010. Rice agriculture is further indicated by the preserved field systems of Caoxieshan, Chuodun and later sites, indicating investment in landscape modification for agricultural systems (Fuller and Qin, 2009). While the Hemudu animal economy focused on deer hunting and fish from fresh water wetlands (Zhang Y., 2014; Nakajima et al., 2010), an age profile shift in pigs suggests ongoing pig domestication during the 5th millennium BC (Zhang Y., 2014).

Parallel processes of early cultivation and domestication of rice can be suggested for societies in the Lower Huai river valley, which joins the lower Yangtze. Slightly predating the Hemudu sites, rice grain impressions, along with stone spades or shovels, are reported from the Houjiazhai culture site of Shuangdun on the Huaihe River in northern Anhui from 5300 to 5050 BC (Zhang and Ren, 2005). Systematic archaeobotanical evidence for assessing domestication status is presently missing. Recently the Shunshanji Neolithic culture, with evidence for rice older than 6000 BC, has been recognized somewhat further north (Nanjing Museum, 2016). However, whether this may come to represent a separate pre-domestication cultivation event or was tied to the spread of cultivation from the Lower Yangtze is presently unclear.

G) The Lower Hanshui and Upper Huai River Basin (Han Basin)

The earliest good evidence for rice cultivation in China comes from this region. Of the two early rice sites, Jiahu I has a wide range of dates, 6900 BC–5800 BC, but potentially, judging from dates on short-lived fruit stones of 6660–6450 cal. BC (see Table S2), is broadly contemporary with the earliest phase of Baligang, dated 6500–6300 cal. BC by direct radiocarbon dates on rice grains (accelerator, or AMS dates). Both sites show a greater cultural affinity with sites to the north than to the south in their earliest phases, suggesting perhaps a pathway to rice cultivation autonomous from developments in the Middle Yangtze (Zhang and Hung, 2013). It may be noted that high levels of *de facto* refuse and caches at sites such as Jiahu might indicate some degree of seasonal mobility.

Archaeobotanical evidence suggests rice within an early stage of cultivation on both sites (Gross and Zhao, 2014), with grain sizes comparable to Kuahuqiao, suggesting an early stage of evolution in this trait (Fuller et al., 2007; Zhao, 2010a; Deng et al., 2015). Jiahu had bone spades and stone shovels (Chen B. et al., 1995; Zhang and Cui, 2013), but such cultivation tools were not discovered at Baligang (Zhang and Hung, 2013). Both sites produced extensive evidence for wild foods, including *Trapa* and acorns, suggesting a pre-agricultural economy. However, systematic archaeobotany at Baligang produced predominantly domesticated rice spikelet bases, suggesting a pathway to non-shattering panicles evolving in advance of the Lower Yangtze by nearly 2000 years, despite a comparable stage in grain size evolution (Deng et al., 2015). This being said, direct dating of the spikelet bases has not been carried out and intrusion from overlying Yangshao levels cannot entirely be ruled out. A few wild-type *Setaria* and *Panicum* grains were also found here, but these may be wild "weeds" of rice as much as crops. Older literature cites the co-occurrence of millet and rice at Jiahu (e.g., Lu, 2005; Sagart, 2008); however, this appears to be based on the misidentification of *Echinochloa,* a potential wild food or weed of early cultivation (see Zhao and Zhang, 2009; 2010a). Further isotope analysis of human skeletons from Jiahu indicated millets were not readily consumed (Hu et al., 2008).

Continuity of these traditions is presently unclear. Baligang has a hiatus of more than a millennium before a clearly agricultural (rice and millet) occupation of the Yangshao culture, Jiahu is abandoned before 5500 BC. Rice impressions in construction debris at Lijiacun and Hejiawan to the west of these sites are broadly dated to the Laoguantai period (c. 5000 BC) and attributed to an early expansion from this region or the Middle Yangtze (Zhu, 2013).

H) The Middle Yangtze – Lishui Valleys (Pengtoushan/Chengbeixi cultures)

These sites are often cited as beginning around 7000 BC, and therefore contemporary with the sites to the north (Crawford and Shen, 1998; Zhang and Cui, 2013; Pei, 2013). However, a critical assessment and recalibration of radiocarbon dates using the 5568 half-life[1] suggests they potentially post-date both Jiahu and Baligang. Unlike Baligang and Jiahu, where radiocarbon dating upon short-lived species was conducted, radiocarbon dates for the earliest rice use from the Middle Yangtze sites are less reliable, showing wide ranges and being based on charcoal or pottery, the latter of which clearly incorporated old carbon. The two accepted dates from Pengtoushan lie between 6590 and 5670 cal. BC (Hedges et al., 1992), with a median of ca. 6000 cal. BC, with later dates from Bashidang, Zaoshi, Chengbeixi, and Zhicheng (Table S2).

The status of rice on these Middle Yangtze sites remains enigmatic as no spikelet bases are available, although the small grain size from Bashidang suggests early stages of

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[1] Radiocarbon ages are calculated on the basis of the estimated half-life of radioactive ^{14}Carbon, which was originally estimated as 5568 by the method's originator Willard Libby. However, later measurements suggest that true half-life was closer to 5730 (the Cambridge half-life) and during the 1970s and 1980s some radiocarbon laboratories, including in China, switched to reporting ages based on this half-life. However, it also became clear by the 1970s that ^{14}C in the atmosphere was not constant and varied over time, therefore age estimates from the half-life need to be calibrated for variation in ^{14}C overtime. This has been worked out by dates from tree-ring s sequences of known age for the past ~10,000 years and corals for older dates. Many laboratories retained the Libby half-life, since the true age is corrected for through calibration programs, and current standards rely on calculations of the radiocarbon age using the 5568 half-life (Stuiver and Polach 1977; Stuiver 1982; Millard 2014). If an age reported based on the Cambridge half-life is entered in a radiocarbon calibration program (such as OxCal) it will return an incorrect and inflated age; such mis-calculations are quite common in some published sources on Chinese archaeology. Therefore throughout this paper we have corrected original Chinese laboratory reports in the Cambridge half-life to the Libby half-life before calibration.

cultivation. Finds of cultivation tools are rare, with occasional bone and wooden tools present at Bashidang (Pei, 2013: Fig. 24.3) and from the Three Gorges Reservoir area before 5000 BC (Zhu et al., 2008: Table 1). By the Daxi period (4500–4000 BC) rice agriculture seems to be well established, based on the presence of bunded fields at Chengtoushan (Fuller and Qin, 2009), accompanied by a well-established arable weed flora (Nasu et al., 2012) as well as evidence that foxtail millet had been adopted in cultivation alongside rice.

4.1 Summary on the origins of rice

On the basis of the present evidence, rice was brought into cultivation within the three outlined areas between 6500 and 5500 BC, but the beginnings of this process and the speed of evolution to domesticated rice and agricultural systems is unclear. Evidence for full domestication presently dates from around 4000 BC in the Lower Yangtze, suggesting a period of 2500 years of pre-domestication cultivation, stretching back to the Shangshan period (around 7000 BC). The Middle Yangtze may have a similar sequence, with domestication in the Daxi period (c. 4500–4000 BC), and incipient cultivation commencing around 6000 BC. In the Upper Han valley, the present evidence from Baligang might suggest domesticated rice much earlier; but given the absence of an *in situ* evolution sequence, this interpretation is unclear, and further investigation and clarification are still needed. Whether the rice cultivators of Jiahu or Baligang persisted or were evolutionary dead-ends also remains unresolved. The early Houli-culture rice found in Shandong remains ambiguous as well, but, as noted above, is more plausibly wild (Fuller, 2011).

5 The integration of rice and millet agriculture, 4000–3500 BC

There is no evidence to suggest that millets and rice were domesticated simultaneously within a single region, or brought into pre-domestication cultivation by a single culture. While it is likely that *Setaria italica* and *Panicum miliaceum* became cultivated and domesticated together, the data for the earliest cultivation stages is too incomplete to assess their eventual integration. Only in the case of Shandong's Houli culture might all three have been cultivated together early on, but the dating of cultivation here is based on the least conclusive evidence of any region, with no evidence supporting a full trajectory to domestication continuing from Houli. The empirical archaeobotanical evidence therefore points to distinct separate processes of plant domestication for Chinese millets and rice, and probably in multiple regions. The fragmentary evidence suggests that millet domestication took millennia, as was the case with rice, wheat, barley and other crops (Fuller et al., 2014); millet cultivation was thus not different in terms of the pace of domestication (*contra* Bettinger et al., 2010a). Some of these starts to cultivation may be evolutionary dead-ends, such as Dadiwan millets, Jiahu rice or Houli. In all cases, the earliest part of the process is most obscure, while the tail end, as agricultural dependence and unambiguous sedentism emerged, is better dated.

In the period leading up to 4000 BC, domesticated rice and millets began to spread. In the case of rice, this seems to have been more restricted to intraregional filling in; thus there is an absence of sites south of the Yangtze. By contrast, millet cultivation spread extensively, especially with the expansion of the Early Yangshao cultural tradition.

<< PLACE FIG. 3 APPROXIMATELY HERE >>

It is at the end of this first expansionary phase, around 4000 BC, that we find the first evidence for the integration of millet and rice agriculture into the economies of single communities (Fig. 3; see Supplementary Materials, Table S3). Largely this represents the uptake of rice by millet farmers, who were culturally more expansive, with numerous Yangshao sites having evidence for both millets and rice. The earliest direct AMS date on rice in the core Yangshao area is 4000–3800 cal. BC, at Nanjiaokou, Sanmenxia (western Henan), from an assemblage dominated by foxtail millet (Qin and Fuller, 2009). Other early Yangshao rice finds could date back to 4500 BC, but lack direct dates. The southern expansion of the Yangshao culture, seen at Baligang and nearby Huitupo in the Upper Han River, starts c. 4300 BC with evidence for cultivation of rice, *Setaria* and *Panicum* (Deng et al., 2015; Weisskopf, 2014). Further south in the Middle Yangtze, foxtail millet has been found at Chengtoushan, otherwise dominated by rice agriculture, 4300–4000 BC (Nasu et al., 2012). It is notable that Lower Yangtze agriculture, well documented up to ca. 2000 BC, focused exclusively on rice, without evidence for millets or soybeans.

6 The southern and western spread of domesticated rice and millet agriculture after 3500 BC

By 3500 BC, the spread of rice and millets appears much more rapid, in particular after 3000 BC, when a significant spread of cereals into regions which had previously seen no cultivation of grain crops occurred (Fig. 4). Prior to 3000 BC, *Panicum* and *Setaria* spread beyond Gansu into western Qinghai and south to western Sichuan (D'Alpoim Guedes and Butler, 2014; Chen F. et al., 2015). There is further evidence for rice within Gansu (e.g., An et al., 2010). The first cultivation in western Sichuan, from ca. 3300 BC, is based exclusively on millets and associated with the Majiayao expansion out of Gansu (derived from the Yangshao culture), with rice added after 2700 BC during the Baodun phase, presumably from a separate expansion up the Yangtze (D'Alpoim Guedes, 2011; Fuller et al., 2010; D'Alpoim Guedes et al., 2013). Further finds of millet from the Tibetan Plateau, Qamdo Karuo, start from c. 2800 BC, but are inferred as traded from a lower elevation (D'Alpoim Guedes and Butler, 2014; D'Alpoim Guedes et al., 2014), although it should be noted this site has stone sickles indicative of harvesting (CPAM, 1985).

<< PLACE FIG. 4 APPROXIMATELY HERE >>

The Baodun culture is the ultimate source of the spread of mixed rice and millet agriculture into Yunnan from around 2500 BC onwards (D'Alpoim Guedes et al., 2013). Rice, foxtail millet and broomcorn millet are found on Neolithic sites at Baiyancun dating between 2500 and 1750 BC (Stevens/Fuller, unpublished data) and later at Haimenkou from 1700 BC (Xue, 2010), Dadunzi (Jin H. et al., 2014) and Shifodong (Zhao, 2010b), both dating from 1500 to 1000 BC (see Table S4).

As for south of the Yangtze, much of the limited evidence relates to the arrival of rice, at a few sites in Guangdong and Fujian dating generally from around 2500 BC (Table S4; Fuller et al., 2010; Zhang and Hung, 2010). Early populations in these areas focused on nuts (acorns, *Canarium*) and vegecultural plants, like palm pith starch, wild bananas and Chinese arrowroot (Yang et al., 2013; Yang, pers. comm.). In Guangxi, foxtail millet and rice co-occur at Gantouyan, probably dating to the 2nd millennium BC (D'Alpoim Guedes et al., 2013).

The other significant movements of rice and millet(s) were to Taiwan and perhaps coastal southern China via maritime routes. Given the absence of millet cultivation in the

Lower Yangtze, it is likely that the first cereals in Taiwan derive from further north, such as the Shandong Peninsula, and were carried with the dispersal of maritime-focused groups, whose presence in Shandong is seen through marine shell midden sites from the Dawenkou through Longshan periods (Yuan et al., 2002b). This hypothesis is further supported by shared burial customs like tooth evulsion (Sagart, 2008). The earliest finds of foxtail millet and rice from lowland sites in western and northern Taiwan date from between c. 2700 and 2300 BC (Tsang, 2005; Hsieh et al., 2011; and see Supplementary Materials, Table S4). *Panicum miliaceum* may also have been present, given its later importance amongst highland Formosan tribes (Fogg, 1983). In addition to cereals, Taiwanese pigs are genetically derived from central China, unlike pigs further south or in the Pacific (Larson et al., 2010). Maritime cultures, perhaps from Shandong, carrying Chinese cereals to Taiwan may also have transmitted farming among the coastally focused fisher-hunter-gatherers of Fujian and eastern Guangdong, which have strong cultural links to each other and to Taiwan (Jiao, 2007), and later perhaps onwards through parts of island and mainland southeast Asia (Bellwood, 2011; Higham, 2014).

This dispersal of rice and millet together into the tropical far south of China provided the passage for cereal agriculture, predominately rice with some foxtail millet, into mainland southeast Asia, perhaps as early as 2500–2000 BC (Weber et al., 2010), but most notably after 2000 BC (Table S4). Likewise, the spread of millets into northern Gansu resulted in their eventual dispersal into Central Asia by at least 2000 BC (Frachetti et al., 2010; Spengler et al., 2014; Table S4). The movement of wheat and barley (along with sheep and cattle) into China is of a likely similar date (Dodson et al., 2013; Barton and An, 2014).

7 The eastern spread of domesticated rice and millet agriculture after 3500 BC

The migration of agriculture out of northeast China brought the cultivation of millets to south-eastern Siberia, just beyond Jilin and Heilongjiang, by 3500–3400 BC (Sergusheva and Vostresov, 2009), millets to the Korean peninsula in the Middle Chulmun period by 3500–3000 BC (Crawford and Lee, 2003; Lee, 2011) followed by rice around 1500 BC (Ahn, 2010), and after some delay both crops to Japan after 700–600 BC.

The movement of foxtail and broomcorn millet into Korea has only a few direct radiocarbon determinations on grains from South Korean sites, suggesting their introduction between 3500 and 3000 cal. BC (Crawford and Lee, 2003; Lee, 2011; Table S4). Early North Korean sites, between 3500 and 2000 BC, include Jitap-ri and Masan-ri where only *Setaria italica* was found, but identifications may be unreliable (Lee, 2011; Kim, 2014). The date of the arrival of rice in Korea is less easy to establish. Early finds from Daechon-ri associated with the arrival of millet are uncharred and hence possibly more recent (Lee, 2011). Other early sites like Oun-1 or grains found in peat also have dating problems or include the possibility that the rice may be wild (Crawford and Lee, 2003; Ahn, 2010). Currently, much of the earliest evidence seems to center around the late 2nd millennium BC, the earliest dates being around 1300–1000 BC (Table S4) when agricultural settlements, stone harvesting knives, wooden tillage and pounding tools are recovered from archaeological sites (Ahn, 2010).

The arrival of foxtail and broomcorn millet, shortly after 3500 BC, was probably either across the sea or around the coast via Liaoning into North Korea, as suggested by Ahn (2010). An earlier dispersal of just millets from northeast China would be congruent with the posited language expansion of Proto-Japano-Koreanic (Robbeets, 2015). Ahn (2010) also suggests that rice entered Korea along a similar northern route via the

Liaodong Peninsula, and while to date there is only one site recorded with rice, Wenjiatun 3000–2600 BC in Liaoning (Miyamoto, 2009), this route has stronger archaeological support.

The final spread of millets and rice into Japan is particularly poorly dated. The earliest two direct dates, both on rice grains from Kazahari, place the introduction of rice agriculture between 980 and 380 cal. BC (Table S4; D'Andrea et al., 1995), but have wide error margins and are in poor agreement with each other. The younger suggests a date of between 780 and 380 cal. BC, and it might be noted that direct dates of 810–550 cal. BC from Ryugasaki on *Panicum miliaceum* (Miyata et al., 2007) suggest a similar introduction date for millets.

8 The demographic and environmental impact of rice and millet farming (3500–2000 BC)

The evidence reviewed above indicates that agricultural economies based on millets in northern China and rice in the Yangtze basin were well established by the start of the 4th millennium BC. In many parts of the Yellow River Basin, rice was also grown by millet farmers, but appears to be a minor component of agriculture in the Yangshao culture (e.g., Lee et al., 2007; Fuller and Zhang, 2007). While the protracted domestication process began probably prior to 6000 BC for both millets and rice, and plausibly independently across as many as 8 regions, the impact of early cultivation on human economies and demography appears minimal initially. Where evidence is available, wild foods largely outranked early cultivated rice (e.g., Fuller et al., 2009; Fuller and Qin 2010; Zhao, 2010a; Deng et al. 2015). The drivers of population growth and expansion through migration must be sought in the period when domesticated cereals and agriculture became established between 4500 BC and 3000 BC. There are two aspects of population expansion that should be considered: internal packing, as sites became larger and denser with more of the available land between them colonized for agriculture, and external expansion, the migration of farmers in search of new land in new regions.

The internal packing of growing populations is demonstrated in the distribution of archaeological sites and by evidence for deforestation, implying acquisition of land for agriculture. As a visual comparison, the distribution of millet-growing sites indicates that the total geographical spread of millet only expanded slightly after 4500 BC and only a little more after 3000 BC (Figs 1, 3, 4; Stevens et al., 2016), but that the total number of sites increased. This pattern is even more striking in comprehensive maps based on survey data (Liu, 2004; Li et al., 2009; Wagner et al., 2013). The other indication is massive and sustained reduction in forest cover, estimated from palynological evidence compiled across the region (Ren, 2007). Pollen-derived estimates of forest cover for the Yangtze basin (including the Huai River) and the Yellow River Basin (Middle and Lower) show that forest cover rose through the early Holocene, presumably due to warmer and wetter climate, with peaks reached around 6000 BC, when forest cover was around 90% for the Yangtze and 50% for the Yellow River. Subsequently, there is a marked and sustained reduction in forest (Fig 5A). After 4000 BC, deforestation stopped in the Yangtze basin, but became more pronounced across north China. While there might be some climatic influence, as northern China was more adversely affected by increased aridification (especially 3500–2000 BC), we would argue that differences in agricultural practices between the two regions were more important. Millet production can be most readily raised by colonizing new land, whereas rice output can be increased by intensification of practices within the same unit of land, which has been seen within archaeological and archaeobotanical data in both the Middle and Lower Yangtze regions (Fuller and Qin, 2009; Weisskopf, 2014; Weisskopf et al., 2015).

<< PLACE FIG. 5 APPROXIMATELY HERE >>

Population growth is evident from the increase in the density of archaeological sites in the landscape and their size range. Several studies of the substantial published archaeological surveys in central and northern China indicate rising site numbers and the growth of larger sites during the course of the Chinese Neolithic (Li et al., 2009; Wagner et al., 2013). The largest compilation across northern China (Yellow River, Inner Mongolia and northeast China) demonstrates a massive increase in total site counts between 8000 and 2000 BC (Fig. 5B). In order to explore this data on a more regional scale, site counts have been averaged per century to account for the different timespans of cultural phases (Fig. 5C–5D). Note that the site count (vertical axis) is a geometric scale, and thus the overall slope of the trends represents approximate geometric (exponential) growth in site number.

In addition to an increasing number of sites, the sites themselves got bigger. While data is not systematically available across all of China, central Henan may be taken as an exemplar (after Liu, 2004). In the Peiligang period (7th millennium BC), the largest site was around 6 hectares, while the median site size was 1 ha. During the Yangshao period (5000-3000 BC), the median site size rose to around 5 ha, the largest being around 40 ha. In the Longshan period (2500–1900 BC) the largest was c. 55 ha, but during the Erlitou period, Erlitou itself reached 300 ha (ca. 1700 BC), with several sites attaining sizes between 30 and 75 ha, although the median was around 3 ha. Thus, the growth of population led to an increased number of village sites, the growth of some urban centers, and agricultural expansion through deforestation.

It is in this context that we need to consider the pressures that promoted the expansion of farming via colonization of new regions, the prime mover that underpins the expansion of farmers and their languages (Bellwood, 2005). As both millet and rice farming populations expanded simultaneously, expansion between millet- and rice-focused regions was constrained. A northward expansion of millet farming was limited by climate, as rainfall and the number of growing days became inadequate for millet farming; these climatic constraints likely intensified with increased aridification leading up to 2000 BC. Thus the main outlets for the migratory expansion of millet farmers was to the west and south (along the edge of the Tibet-Qinghai highlands), and eastwards into the Korean Peninsula, far eastern Russia, and potentially, by maritime links, to Taiwan and non-agricultural southeast China. These archaeologically appear as the main areas of expansion, especially during the 3rd millennium BC. Presumably, the initial pulse in population growth early in the Yangshao-Dawenkou era (4th millennium BC) was focused on internal expansion and deforestation, with the second pulse increasingly leading to external migration.

Rice farming was less expansive initially. The ability to intensify wet rice agriculture in the Yangtze basin and its tributaries potentially absorbed considerable population growth through intra-regional population packing. Additionally, the high labor costs of wet rice agriculture probably made its translocation by small frontier populations formidable, and potentially also reduced the attraction of adopting such systems to other societies, creating friction to its dispersal (Fuller and Qin, 2009). Instead, rice only spread to southeast Asia once less labor-demanding rainfed (dry) rice systems evolved (Fuller et al., 2011; Castillo et al., 2016).

9 Concluding remarks: Implications for language dispersal

Early cultivation practices are unlikely to have caused major shifts in the distribution of population and, by association, culture or language. Rather, the archaeological evidence for the development of agriculture in China argues for major demographic expansions, which can be expected to have spread major language families geographically, to have taken place from the end of the domestication process. These dispersal processes took place out of the central plains of China, including the middle and lower basin of the Yangtze and lower basin of the Yellow River. Two major demographic pulses are identified that are associated with the establishment of agriculture; the first began around 4000 BC, intensifying between 3000–2500 BC. The first pulse witnessed the spread of millets westward and eastward, while the second pulse saw major expansions of rice and millet southwards by three major routes (Yunnan, Guangdong, and to the southeast). Thus, we have five geographical trajectories of agricultural spread, and perhaps it is no coincidence that five language families have been postulated as having experienced agriculturally based expansions out of greater China (Sino-Tibetan, Austronesian, Austroasiatic, Hmong-Mein and Japano-Koreanic). Alternative theories purporting to explain geographical derivations from Sino-Tibetan, such as the highly diverse Tibeto-Burman language zone of Northeastern India through Yunnan (e.g., van Driem, 2012), should be rejected, as they are clearly contravened by the archaeological evidence (for an explicit quantitative test of fit with rice data, see Silva et al., 2015). Nevertheless, there is much work to be done to tie together the linguistic evidence for proto-language farming vocabularies, or other associated material culture, and the archaeological geographies of early farming. What the archaeobotanical evidence can provide is a map, in time and space, of subsistence systems, where cultivation began, domestication evolved and agriculture became established as part of demographic expansion.

Supplementary Materials

Table S1 listing sites with archaeobotanical evidence for millet and/or evidence for cultivation and dating. Table S2 showing sites with rice. Table S3 listing earliest sites with co-occurrence of millets and rice. Table S4 sites with rice and/or millets from Western China, Tibet, Central Asia, Korea and Japan.

References

Ahn, Sung-Mo. 2010. The emergence of rice agriculture in Korea: Archaeobotanical perspectives. *Archaeological and Anthropological Sciences* 2: 89-98.

An, Chengbang, Duxue Ji, Fa-hu Chen, Guanghui Dong, Hui Wang, Weimiao Dong, and Xueye Zhao. 2010. Evolution of prehistoric agriculture in central Gansu Province, China: A case study in Qin'an and Li County. *Chinese Science Bulletin* 55(18): 1925-1930.

Asouti, Eleni and Dorian Q Fuller. 2013. A contextual approach to the emergence of agriculture in Southwest Asia: reconstructing Early Neolithic plant-food production. *Current Anthropology* 54(3): 299-345.

Barton, Loukas. 2009. *Early Food Production in China's Western Loess Plateau.* PhD dissertation, University of California, Davis.

Barton, Loukas and Chengbang An. 2014. An evaluation of competing hypotheses for the early adoption of wheat in East Asia. *World Archaeology* 46(5): 775-798.

Barton, Loukas, Seth D. Newsome, Fa-Hu Chen, Hui Wang, Thomas P. Guilderson, and Robert L. Bettinger. 2009. Agricultural origins and the isotopic identity of domestication in northern China. *Proceedings of the National Academy of Sciences of the U.S.A.* 106(14): 5523-5528.

Bellwood, Peter. 2005. *First Farmers*. Oxford: Blackwell.

Bellwood, Peter. 2011. The checkered prehistory of rice movement southwards as a domesticated cereal – from the Yangzi to the Equator. *Rice* 4(3-4): 93-103.

Bellwood, Peter and Colin Renfrew (eds.). 2003. *Assessing the Languaging/Farming Dispersal Hypothesis*. Cambridge: McDonald Institute for Archaeological Research.

Bestel, Sheahan, Gary W. Crawford, Li Liu, Jinming Shi, Yanhua Song, and Xingcan Chen. 2014. The evolution of millet domestication, Middle Yellow River Region, North China: Evidence from charred seeds at the late Upper Paleolithic Shizitan Locality 9 site. *The Holocene* 24(3): 261-265.

Bettinger, Robert L., Loukas Barton, and Christopher Morgan. 2010a. The origins of food production in North China: A different kind of agricultural revolution. *Evolutionary Anthropology* 19: 9-21.

Bettinger, Robert L., Loukas Barton, Christopher Morgan, Fa-hu Chen, Hui Wang, Thomas P. Guilderson, Duxue Ji, and Dongju Zhang. 2010b. The transition to agriculture at Dadiwan, People's Republic of China. *Current Anthropology* 51(5): 703-714.

Binford, Lewis R. 1968. Post-pleistocene adaptations. In Sally R, Binford and Lewis R. Binford (eds.) *New Perspectives in Archaeology*, 313-341. Chicago: Aldine.

Blench, Roger. 2005. From the mountains to the valleys: Understanding ethnolinguistic geography in SE Asia. In Laurent Sagart, Roger Blench, and Alicia Sanchez-Mazas (eds.), *The Peopling of East Asia,* 31-50. London: Routledge.

Bocquet-Appel, Jean-Pierre. 2011. The agricultural demographic transition during and after the agriculture inventions. *Current Anthropology* 52 (S4): S497-S510.

Castillo, Cristina C., Katsunori Tanaka, Yo-Ichiro Sato, Ryuji Ishikawa, Bérénice Bellina, Charles Higham, Nigel Chang, Rabi Mohanty, Mukund Kajale, and Dorian Q Fuller. 2016. Archaeogenetic study of prehistoric rice remains from Thailand and India: Evidence of early japonica in South and Southeast Asia. *Archaeological and Anthropological Sciences* 8(3): 523-543.

Chang, Kwang-chih. 1986. *The Archaeology of Ancient China.* 4th ed. New Haven: Yale Press.

Chen, Baozhang, Zhang Juzhong, and Houyuan Lu. 1995. Discovery of rice phytoliths in the Neolithic site at Jiahu, Henan province and its significance. Translation by G. Leir. *Chinese Science Bulletin* 14(40): 1186-1191. [in Chinese]

Chen, Fa-hu, Guanghui Dong, Dongju Zhang, Xinyi Liu, Xia Jia, Chengbang An, and Martin K. Jones. 2015. Agriculture facilitated permanent human occupation of the Tibetan Plateau after 3600 BP. *Science* 347(6219): 248-250.

Choi, Jae Young, Adrian E. Platts, Dorian Q Fuller, Yue-le Hsing, Rod A. Wing, and Michael D. Purugganan. 2017. The rice paradox: Multiple origins but single domestication in Asian rice. *Molecular Biology and Evolution*. DOI: 10.1093/molbev/msx049

Cohen, David J. 2011. The beginnings of agriculture in China. A multiregional view. *Current Anthropology* 52(S4): S273-S293.

CPAM (Commission for the Preservation of Ancient Monuments, Tibet) and Sichuan University Department of History. 1985. *Karou: A Neolithic Site in Tibet*. Beijing: IACASS. [in Chinese]

Crawford, Gary W. 2012. Early rice exploitation in the lower Yangzi valley: What are we missing? *The Holocene* 22(6): 613-621.

Crawford, Gary W., Xuexiang Chen, Fengshi Luan, and Jianhua Wang. 2016. People and plant interaction at the Houli Culture Yuezhuang site in Shandong Province, China. *The Holocene* 26 (10): 1594-1604.

Crawford, Gary W., Xuexiang Chen, and Jianhua Wang. 2006. Discovery of fossilized crops from the Houli site of Yuezhuang in the Jinan Region of Shandong. *Dongfang Kaogu* 3: 247-251. [in Chinese]

Crawford, Gary W. and Gyoung-Ah Lee. 2003. Agricultural origins in the Korean peninsula. *Antiquity* 77(295): 87-95.

Crawford, Gary W. and Chen Shen. 1998. The origins of rice agriculture: Recent progress in East Asia. *Antiquity* 72(278): 858-866.

D'Alpoim Guedes, Jade. 2011. Millets, rice, social complexity, and the spread of agriculture to the Chengdu Plain and southwest China. *Rice* 4: 104-113.

D'Alpoim Guedes, Jade and Ethan E. Butler. 2014. Modelling constraints on the spread of agriculture to Southwest China with thermal niche models. *Quaternary International* 349: 29-41.

D'Alpoim Guedes, Jade, Ming Jiang, Kunyu He, Xiaohong We, and Zhanghua Jiang. 2013. Site of Baodun yields earliest evidence for the spread of rice and foxtail millet agriculture to south-west China. *Antiquity* 87: 758-771.

D'Alpoim Guedes, Jade, Guiyun Jin, and R. Kyle Bocinsky. 2015. The impact of climate on the spread of rice to north-eastern China: A new look at the data from Shandong Province. *PLoS ONE* 10(6): e0130430. doi:10.1371/journal.pone.0130430.

D'Alpoim Guedes, Jade, Hongliang Lu, Yongxian Li, Robert N. Spengler, Xiaohong Wu, and Mark S. Aldenderfer. 2014. Moving agriculture onto the Tibetan plateau: The archaeobotanical evidence. *Archaeological and Anthropological Sciences* 6: 255-269.

D'Andrea, A. Catherine, Gary Crawford, Masakazu Yoshizaki, and Takehisa Kudo. 1995. Late Jomon cultigens in northeastern Japan. *Antiquity* 69: 146-152.

De Wet, J. M. J. 2000. Millets. In Kenneth F. Kiple and Kriemhild F. Ornelas (eds.), *Cambridge World History of Food,* 112-121. Cambridge: Cambridge University Press.

Deng, Zhenhua, Ling Qing, Yu Gao, Alison Ruth Weisskopf, Chi Zhang, and Dorian Q Fuller. 2015. From early domesticated rice of the Middle Yangtze basin to millet, rice and wheat agriculture: Archaeobotanical macro-remains from Baligang, Nanyang basin, Central China (6700-500 BC). *PLoS ONE* 10(10): e0139885. doi:10.1371/journal.pone.0139885.

Dodson, John R., Xiaoqiang Li, Xinying Zhou, Keliang Zhao, Nan Sun, and Pia Atahan. 2013. Origin and spread of wheat in China. *Quaternary Science Reviews* 72: 108-111.

Eda, Meiko, Ayumi Izumitani, Katsuyuki Ichitani, Makoto Kawase, and Kenji Fukunaga. 2013. Geographical variation of foxtail millet, Setaria italica (L.) P. Beauv. based on rDNA PCR–RFLP. *Genetic Resources and Crop Evolution* 60(1): 265-274.

Ellis, Erle C. and Siming Wang. 1997. Sustainable traditional agriculture in the Tai Lake Region of China. *Agriculture, Ecosystems, and Environment* 61: 177-193.

Flad, Rowan K., Jing Yuan, and Shuicheng Li. 2007. Zooarchaeological evidence for animal domestication in Northwest China. In David B. Madsen, Fa-Hu Chen, and Xing Gao (eds.), *Late Quaternary Climate Change and Human Adaptation in Arid China,* 163-199. Amsterdam: Elsevier.

Fogg, Wayne H. 1983. Swidden cultivation of foxtail millet by Taiwan aborigines: A cultural analogue of the domestication of Setaria italica in China. In David N. Keightley (ed.), *The Origins of Chinese Civilization,* 95-115. Berkeley: University of California Press.

Frachetti, Michael D., Robert N. Spengler, Gayle J. Fritz, and Alexei N. Mar'yashev. 2010. Earliest direct evidence for broomcorn millet and wheat in the central Eurasian steppe region. *Antiquity* 84: 993-1010.

Fuller, Dorian Q. 2011. Pathways to Asian civilizations: Tracing the origins and spread of rice and rice cultures. *Rice* 4: 78-92.

Fuller, Dorian Q, Tim Denham, Manuel Arroyo-Kalin, Leilani Lucas, Chris J. Stevens, Ling Qin, Robin G. Allaby, and Michael D. Purugganan. 2014. Convergent evolution and parallelism in plant domestication revealed by an expanding archaeological record. *Proceedings of the National Academy of Sciences of the U.S.A.* 111(17): 6147-6152.

Fuller, Dorian Q, Emma Harvey, and Ling Qin. 2007. Presumed domestication? Evidence for wild rice cultivation and domestication in the fifth millennium BC of the lower Yangtze region. *Antiquity* 81: 316-331.

Fuller, Dorian Q and Ling Qin. 2009. Water management and labour in the origins and dispersal of Asian rice. *World Archaeology* 41(1): 88-111.

Fuller, Dorian Q and Ling Qin. 2010. Declining oaks, increasing artistry, and cultivating rice: The environmental and social context of the emergence of farming in the Lower Yangtze Region. *Environmental Archaeology* 15(2): 139-159.

Fuller, Dorian Q, Ling Qin, Yunfei Zheng, Zhijun Zhao, Xugao Chen, Leo Aoi Hosoya, and Guo-Ping Sun. 2009. The domestication process and domestication rate in rice: Spikelet bases from the Lower Yangtze. *Science* 323(5921): 1607-1610.

Fuller, Dorian Q, Yo-Ichiro Sato, Cristina Castillo, Ling Qin, Alison R. Weisskopf, Eleanor J. Kingwell-Banham, Jixiang Song, Sung-Mo Ahn, and Jacob van Etten. 2010. Consilience of genetics and archaeobotany in the entangled history of rice. *Archaeological and Anthropological Sciences* 2(2): 115-131.

Fuller, Dorian Q, Jacob van Etten, Katie Manning, Cristina Castillo, Eleanor Kingwell-Banham, Alison Weisskopf, Qin Ling, Yo-Ichiro Sato, and Robert J. Hijmans. 2011. The contribution of rice agriculture and livestock pastoralism to prehistoric methane levels: An archaeological assessment. *The Holocene* 21(5): 743-759.

Fuller, Dorian Q, Alison R Weisskopf, and Cristina Cobo Castillo. 2016. Pathways of rice diversification across Asia. *Archaeology International* 19: 84-96.

Fuller, Dorian Q and Hai Zhang. 2007. A preliminary report of the survey archaeobotany of the Upper Ying Valley (Henan Province). In School of Archaeology and Museology, Peking University, and Henan Provincial Institute of Cultural Relics and Archaeology (eds.), *Dengfeng wangchenggang yizhi de faxian yu yanjiu* (2002-2005) [Archaeological Discovery and Research at the Wangchenggang Site in Dengfeng (2002-2005)], 916-958. Zhengzhou: Great Elephant Publisher. [in Chinese]

Gross, Briana L. and Zhijun Zhao. 2014. Archaeological and genetic insights into the origins of domesticated rice. *Proceedings of the National Academy of Sciences of the U.S.A.* 111(17): 6190-6197.

Guerrero, Emma, Stephan Naji, and Jean-Pierre Bocquet-Appel. 2008. The signal of the Neolithic demographic transition in the Levant. In Jean-Pierre Bocquet-Appel and

Ofer Bar-Yosef (eds.) *The Neolithic demographic transition and its consequences*, 57-80. Dordecht: Springer

Harris, David and Dorian Q Fuller. 2014. Agriculture: Definition and overview. In Claire Smith (ed.), *Encyclopaedia of Global Archaeology,* 104-113.

Hedges, Richard E. M., Rupert A. Housley, Christopher Bronk Ramsey, and Gert Jaap van Klinken. 1992. Radiocarbon dates from the oxford AMS system: Archaeometry datelist 14. *Radiocarbon* 34(1): 141-159.

Higham, Charles. 2014. *Early Mainland Southeast Asia: From First Humans to Angkor.* River Books: Bangkok.

Hsieh, Jaw-shu, Yue-ie Caroline Hsing, Tze-fu Hsu, Paul Jen-kuei Li, Kuang-ti Li, and Cheng-hwa Tsang. 2011. Studies on ancient rice – Where botanists, agronomists, archeologists, linguists, and ethnologists meet. *Rice* 4: 178-183.

Hosoya, Leo Aoi, Michèle Wollstonecroft, Dorian Q Fuller, and Qin Ling. 2010. Experimental pilot study of peach/ apricot kernel detoxification: For reconstruction of Chinese early rice farmers broad spectrum subsistence strategy. In Keisuke Makibayashi and Megumi Uchikado (eds.), *Studies of Landscape History of East Asian Inland Seas,* 457-464. Kyoto: Research Institute for Humanity and Nature.

Hu, Yaowu, Shougong Wang, Fengshi Luan, Changsui Wang, and Michael P. Richards. 2008. Stable isotope analysis of humans from Xiaojingshan site: Implications for understanding the origin of millet agriculture in China*. Journal of Archaeological Science* 35: 2960-2965.

Jiang, Leping. 2007. Zhejiang Pujiangxian Shangshan yizhi fajue jianbao. *Kaogu* 9: 7-19. [in Chinese]

Jiao, Tianlong. 2007. *The Neolithic of Southeast China Cultural Transformation and Regional Interaction on the Coast.* Youngstown: Cambria Press.

Jin, Guiyun, Wenwan Wu, Kesi Zhang, Zebing Wang, and Xiaohong Wu. 2014. 8000-year old rice remains from the north edge of the Shandong Highlands, East China. *Journal of Archaeological Science* 51: 34-42.

Jin, Hetian, Xu Liu, Rui Min, Xiaorui Li, and Xiaohong Wu. 2014. Early subsistence practices at prehistoric Dadunzi in Yuanmou, Yunnan: New evidence for the origins of early agriculture in southwest China. In Anke Hein (ed.), *The 'Crescent-shaped Cultural-communication Belt': Tong Enzheng's Model in Retrospect: An Examination of Methodological, Theoretical and Material Concerns of Long Distance Interactions in East Asia,* BAR International Series 2679, 133-140. Oxford: Archaeopress.

Kim, Minkoo. 2014. Rice, ethnicity and the collation of archaeobotanical data for prehistoric Korea. *Archaeologies* 10(2): 168-193.

Lanehart, Rheta E., Robert H. Tykot, Anne P. Underhill, Fenghui Luan, Haiguang Yu, Hui Fang, Cai Fengshu, Gary Feinman, and Linda Nicholas. 2011. Dietary adaptation during the Longshan period in China: Stable isotope analyses at Liangchengzhen (southeastern Shandong). *Journal of Archaeological Science* 38(9): 2171-2181.

Larson, Greger, Ranran Liu, Xingbo Zhao, Jing Yuan, Dorian Fuller, Loukas Barton, Keith Dobney, Qipeng Fan, Zhiliang Gu, Xiao-Hui Liu, Yunbing Luo, Peng Lv, Leif Andersson, and Ning Li. 2010. Patterns of East Asian pig domestication, migration, and turnover revealed by modern and ancient DNA. *Proceedings of the National Academy of Sciences of the U.S.A.* 107(17): 7686-7691.

Lee, Gyoung-Ah. 2011. The transition from foraging to farming in prehistoric Korea. *Current Anthropology* 52(S4): S307-S329.

Lee, Gyoung-Ah, Gary W. Crawford, Li Liu, and Xingcan Chen. 2007. Plants and people from the Early Neolithic to Shang periods in North China. *Proceedings of the National Academy of Sciences of the U.S.A.* 104(3): 1087-1092.

Lee, Gyoung-Ah, Gary W. Crawford, Li Liu, and Xingcan Chen. 2011. Archaeological soybean (Glycine max) in East Asia: Does size matter? *PLoS ONE* 6(11): e26720. doi:10.1371/journal.pone.0026720.

Li, Xiaoqiang, John Dodson, Jie Zhou, and Xinying Zhou. 2009. Increases of population and expansion of rice agriculture in Asia, and anthropogenic methane emissions since 5000 BP. *Quaternary International* 202(s1-2): 41-50.

Liu, Li. 2004. *The Chinese Neolithic. Trajectories to Early States.* Cambridge: Cambridge University Press.

Liu, Li and Xingcan Chen. 2012. *The Archaeology of China.* Cambridge: Cambridge University Press.

Liu, Li, Gyoung-Ah Lee, Leping Jiang, and Juzhong Zhang. 2007. The earliest rice domestication in China. *Antiquity* 81(313). Available online at http://www.antiquity.ac.uk/projgall/liu1/ (accessed June 26, 2017).

Lu, Houyuan, Jianping Zhang, Kam-biu Liu, Naiqin Wu, Yumei Li, Kunshu Zhou, Maolin Ye, Tianyu Zhang, Haijiang Zhang, Xiaoyan Yang, Licheng Shen, Deke Xu, and Quan Li. 2009. Earliest domestication of common millet (Panicum miliaceum) in East Asia extended to 10,000 years ago. *Proceedings of the Natural Academy of Sciences of the U.S.A*. 106(18): 7367-7372.

Lu, Tracey Lie Dan. 1999. *The transition from foraging to farming and the origin of agriculture in China.* BAR International Series 774. Oxford: British Archaeological Reports

Maeda, Osamu, Leilani Lucas, Fabio Silva, Ken-Ichi Tanno, Dorian Q Fuller. 2016. Narrowing the harvest: Increasing sickle investment and the rise of domesticated cereal agriculture in the Fertile Crescent. *Quaternary Science Reviews* 145: 226-237

Makibayashi, Keisuke. 2014. The transformation of farming cultural landscapes in the Neolithic Yangtze area, China. *Journal of World Prehistory* 27(3-4): 295-307.

Millard, Andrew R. 2014. Convention for reporting radiocarbon determinations. *Radiocarbon* 56(2): 555-559

Miyamoto, Kazuo. 2009. *Noukounokigenwosaguru* [In search of the origin of agriculture]. Tokyo: Yoshikawa kōbunkan. [in Japanese]

Miyata, Yoshiki, Takanobu Kojima, Akiko Matsutani, Shin Onbe, and Toyohiro Nishimoto. 2007. Oldest common millet from western Japan: Carbonized material adhering to pottery from the Ryugasaki A site, Shiga prefecture. In Mineo Imamura and Kenichi Kobayashi (eds.), *Bulletin of the National Museum of Japanese History 137,* 255-265. Chiba: National Museum of Japanese History. [in Japanese with English abstract]

Nanjing Museum and Jiangsu Province Institute. 2016. *Shunshanji.* Beijing: Science Press. [in Chinese]

Nasu, Hiroo, Haibin Gu, Arata Momohara, and Yoshinori Yasuda. 2012. Land-use change for rice and foxtail millet cultivation in the Chengtoushan site, central China, reconstructed from weed seed assemblages. *Archaeological and Anthropological Sciences* 4(1): 1-14.

Pechenkina, Ekaterina A., Stanley H. Ambrose, Ma Xiaolin, and Robert A. Benfer Jr. 2005. Reconstructing Chinese Neolithic subsistence practices by isotopic analysis. *Journal of Archaeological Science* 32: 1176-1189.

Pei, Anping. 2013. The Pengtoushan culture in the Middle Yangzi River Valley. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology,* 497-509. Oxford: Blackwell.

Qin, Ling and Dorian Q Fuller. 2009. Discussion on plant remains of the early and middle Yangshao Period from Nanjiaokou Site, Henan Province and related topics. In Henan Provincial Institute of Archaeology and Cultural Relics (eds.), *Sanmenxia Nanjiaokou,* 427-435. Beijing: Science Press. [in Chinese]

Ren, Guoyu. 2007. Changes in forest cover during the Holocene. *Vegetation History and Archaeobotany* 16: 119-126.

Ren, Shinan. 1996. Several major achievements in Early Neolithic China, ca. 5000 BC. Translation by Wing Kam Cheung. *Kaogu* 1996: 37-49.

Richardson, Peter J., Robert Boyd, and Robert Bettinger. 2001. Was agriculture impossible during the Pleistocene but mandatory during the Holocene? A climate change hypothesis. *American Antiquity* 66(3): 387-411.

Robbeets, Martine I. 2015. Proto-Transeurasian: Where and when? *Man in India* 95(3-4): 921-946.

Sagart, Laurent. 2008. The expansion of Setaria farmers in East Asia: A linguistic and archaeological model. In Alicia Sanchez -Mazas, Roger Blench, Malcolm Ross, Ilia Peiros, and Marie Lin (eds.), *Past Human Migrations in East Asia: Matching Archaeology, Linguistics and Genetics,* 133-157. London: Routledge.

Sagart, Laurent. 2011. How many independent rice vocabularies in Asia?. *Rice* 4(3-4): 121-133.

Sergusheva, Elena A. and Yury E. Vostretsov. 2009. The advance of agriculture in the coastal zone of East Asia. In Andrew S. Fairbairn and Ehud Weiss (eds.), *From Foraging to Farming: Papers in Honour of Gordon C. Hillman,* 205-219. Oxford: Oxbow Books.

Shelach, Gideon and Mingyu Teng. 2013. Earlier Neolithic economic and social systems of the Liao River region, northeast China. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology,* 37-54. Oxford: Blackwell.

Silva, Fabio, Chris Stevens, Alison Weisskopf, Cristina Castillo, Ling Qin, Andrew Bevan, and Dorian Q Fuller. 2015. Modelling the origin of rice farming in Asia using the Rice Archaeological Database. *PloS ONE* 10(9): e0137024. doi:10.1371/journal.pone.0137024.

Smith, Bruce D. 2001. Low-level food production. *Journal of Archaeological Research* 9(1): 1-4.

Smith, Bruce D. 2015. A comparison of niche construction theory and diet breadth models as explanatory frameworks for the initial domestication of plants and animals. *Journal of Archaeological Research* 23(3): 215-262.

Song, Jixiang. 2011. *The Agricultural Economy during Longshan Period: An Archaeobotanical Perspective from Shandong and Shanxi.* PhD dissertation, University College London.

Spengler, Robert, Michael Frachetti, Paula Doumani, Lynne Rouse, Barbara Cerasetti, Elissa Bullion, and Alexei Mar'yashev. 2014. Early agriculture and crop transmission among Bronze Age mobile pastoralists of Central Eurasia. *Proceedings of the Royal Society B* 281: 20133382.

Stevens, Chris J., Charlene Murphy, Rebecca Roberts, Leilani Lucas, Fabio Silva, and Dorian Q Fuller. 2016. Between China and South Asia: A Middle Asian corridor of crop dispersal and agricultural innovation in the Bronze Age. *The Holocene* 26(10): 1541-1555. doi: 10.1177/0959683616650268.

Stuiver, Minze. 1982. A high-precision calibration of the AD radiocarbon time scale. *Radiocarbon* 24(1): 1-26.

Stuiver, Minze and Henry A. Polcah. 1977. Reporting of ^{14}C Data. *Radiocarbon* 19(3): 355-363

Tsang, Cheng-hwa. 2005. Recent discoveries at a Tapenkeng Culture Site in Taiwan: Implications for the problems of Austronesian Origins. In Laurent Sagart, Roger Blench, and Alicia Sanchez-Mazas (eds.), *The Peopling of East Asia,* 63-73. London: Routledge.

Underhall, Anne P. 2013. Introduction: investigating the development and nature of complex societies in Ancient China. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology,* 1-12. Oxford: Blackwell.

Van Driem, George. 2012. The ethnolinguistic identity of the domesticators of Asian rice. *Comptes Rendus Palevol* 11(2): 117-132.

Wagner, Mayke, Pavel Tarasov, Dominic Hosner, Andreas Fleck, Richard Ehrich, Xiaocheng Chen, and Christian Leipe. 2013. Mapping of the spatial and temporal distribution of archaeological sites of northern China during the Neolithic and Bronze Age. *Quaternary International* 290-291: 344-357.

Weber, Steve, Heather Lehman, Timothy Barela, Sean Hawks, and David Harriman. 2010. Rice or millets: Early farming strategies in central Thailand. *Archaeological and Anthropological Sciences* 2(2): 79-88.

Weisskopf, Alison Ruth. 2014. *Millets, Rice and Farmers: Phytoliths as Indicators of Agricultural, Social and Ecological Change in Neolithic and Bronze Age Central China.* BAR International Series 2589. Oxford: Archaeopress.

Weisskopf, Alison and Dorian Q Fuller. 2014. Peach: Origins and development. In Claire Smith (ed.), *Encyclopedia of Global Archaeology,* 5840-5842. New York: Springer.

Weisskopf, Alison, Ling Qin, Jinlong Ding, Ping Ding, Guoping Sun, and Dorian Q Fuller. 2015. Phytoliths and rice: From wet to dry and back again in the Neolithic Lower Yangtze. *Antiquity* 89(347): 1051-1063.

Wu, Wenwan, Xinghua Wang, Xiaohong Wu, Guiyun Jin, and Pavel E. Tarasov. 2014. The early Holocene archaeobotanical record from the Zhangmatun site situated at the northern edge of the Shandong Highlands, China. *Quaternary International* 348: 183-193.

Wu, Yan, Leping Jiang, Yunfei Zheng, Changsui Wang, and Zhijun Zhao. 2014. Morphological trend analysis of rice phytolith during the early Neolithic in the Lower Yangtze. *Journal of Archaeological Science* 49: 326-331.

Xie, Liye, Steven L. Kuhn, Guoping Sun, John Olsen, W. Yunfei Zheng, Pin Ding, and Ye Zhao. 2015. Labor costs for prehistoric earthwork construction: Experimental and archaeological insights from the Lower Yangzi basin, China. *American Antiquity* 80(1): 67-88.

Xue, Yining. 2010. *A Preliminary Study of Plant Remains from Haimenkou, Yunnan, Jianchuan.* Masters thesis, Peking University.

Yang, Xiaoyan, Huw J. Barton, Zhiwei Wan, Quan Li, Zhikun Ma, Mingqi Li, Dan Zhang, Jun Wei. 2013. Sago-Type Palms Were an Important Plant Food Prior to Rice in Southern Subtropical China. *PLoS ONE* 8(5): e63148. doi:10.1371/journal.pone.0063148.

Yang, Xiaoyan, Zhikun Ma, Jun Li, Jincheng Yu, Chris Stevens, and Yijie Zhuang. 2015. Comparing subsistence strategies in different landscapes of North China 10000 years ago. *The Holocene* 25(12): 1957-1964.

Yang, Xiaoyan, Zhiwei Wan, Linda Perry, Houyuan Lu, Qiang Wang, Chaohong Zhao, Jun Li, Fei Xie, Jincheng Yu, Tianxing Cui, Tao Wang, Mingqi Li, and Quansheng Ge. 2012a. Early millet use in northern China. *Proceedings of the National Academy of Sciences of the U.S.A*. 109(10): 3726-3730.

Yang, Xiaoyan, Jianping Zhang, Linda Perry, Zhikun Ma, Zhiwei Wan, Mingqi Li, Xianmin Diao, and Houyuan Lu. 2012b. From the modern to the archaeological: Starch grains from millets and their wild relatives in China. *Journal of Archaeological Science* 39(2): 247-254.

Yuan, Jing and Rowan K. Flad. 2002a. Pig domestication in ancient China. *Antiquity* 76(293): 724-732.

Yuan, Jing, Liang Zhonghe, Wu Yun, and Jia Xiaobing. 2002b. Shell mounds in the Jiaodong peninsula: A study in environmental archaeology. *Journal of East Asian Archaeology* 4: 1-4.

Zeder, Melinda A. 2015. Core questions in domestication research. *Proceedings of the National Academy of Sciences* 112(11): 3191-3198.

Zhang, Chi and Hsiao-chun Hung. 2010. The emergence of agriculture in southern China. *Antiquity* 84: 11-25.

Zhang, Chi and Hsiao-chun Hung. 2013. Jiahu 1: Earliest farmers beyond the Yangtze River. *Antiquity* 87: 46-63.

Zhang, Juzhong and Qikun Ren. 2005. Past and future prospects in Anhui prehistoric rice agricultural research. Translation by Elaine Wong. *Agricultural Archaeology* 2005, 156-160.

Zhang, Xun, J. Wang, Z. Xi, and Sui Qiu. 2003. Studies on ancient human diets. *Kaogu* 2: 62-75. [in Chinese]

Zhang, Ying. 2014. *Animal Procurement Strategies in Neolithic of the Yangtze River Basin: Zooarchaeological and Ecological Approaches.* PhD dissertation, University College London.

Zhao, Zhijun. 2004. Cong Xinglonggou yizhi fuxuan jieguo tan Zhongguo beifang hanzou nongye qiyuan wenti (Addressing the origins of agriculture in north China based on the results of flotation from the Xinglonggou site). *Dongya Kaogu* 12: 188-199. [in Chinese]

Zhao, Zhijun. 2010a. New data and new issues for the study of origin of rice agriculture in China. *Archaeological and Anthropological Sciences* 2(2): 99-105.

Zhao, Zhijun. 2010b. Report on the archaeobotanical remains unearthed at the site of Shifodong. In Yunnan Sheng Kaogusuo and Chengdu Shi Wenwu Kaogu Yanjiusuo (eds.), *Shifodong in Gengma County,* 368-373. Beijing: Wenwu Chubanshe. [in Chinese].

Zhao, Zhijun. 2011. New archaeobotanical data for the study of the origins of agriculture in China. *Current Anthropology* 52(S4): S295-S306.

Zhao, Zhijun. 2015. Archaeobotanical evidence for the transition to millet farming in North China. Paper presented at the conference "Dialogue of Civilizations: Comparing Multiple Centres of Early Civilizations of the World," Beijing, April 2015.

Zhao, Zijiun and Juzhong Zhang. 2009. The report of flotation work at the Jiahu site. *Kaogu* 8: 86-95. [in Chinese]

Zheng, Yunfei, Gary W. Crawford, and Xugao Chen. 2014. Archaeological evidence for peach (Prunus persica) cultivation and domestication in China. *PLoS ONE* 9(9): e106595. doi:10.1371/journal.pone.0106595.

Zhu, Guangyao, Cheng Zhu, Guang Yue Shi, and Zhibin Sun. 2008. Relations between man and nature reflected by the evolution of the Neolithic production tools in the Three Gorges region of Yangtze River, China. *Chinese Science Bulletin* 53(S1): 95-106.

Zhu, Yangping. 2013. The early Neolithic in the Central Yellow River valley, c. 7000–4000 BC. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology,* 171-193. Oxford: Blackwell.

ZPIACR (Zhejiang Provincial Institute of Cultural Relics and Archaeology). 2004*. Kuahuqiao.* Beijing: Cultural Relics Publishing House. [in Chinese]

Figure captions

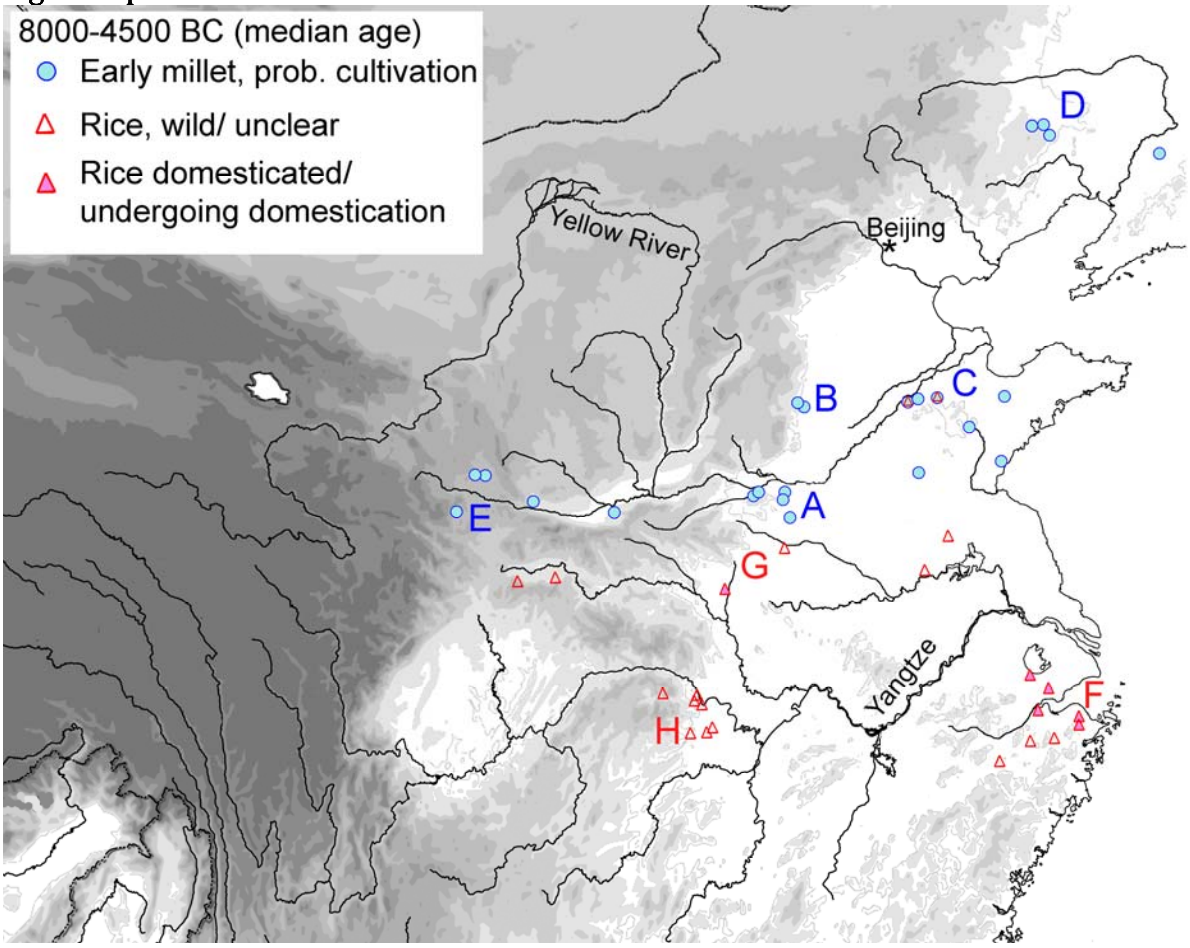

Figure 1. Distribution of early sites with archaeobotanical finds of millet and/or rice with median ages between 8000 and 4500 BC. Morphologically wild and domesticated rice differentiated. Regional cultures indicated: A. Peiligang, B. Cishan, C. Houli, D. Xinglongwa, E. Dadiwan, F. Lower Yangtze Neolithic, G. Upper Huai/ Han Neolithic, H. Middle Yangtze Neolithic.

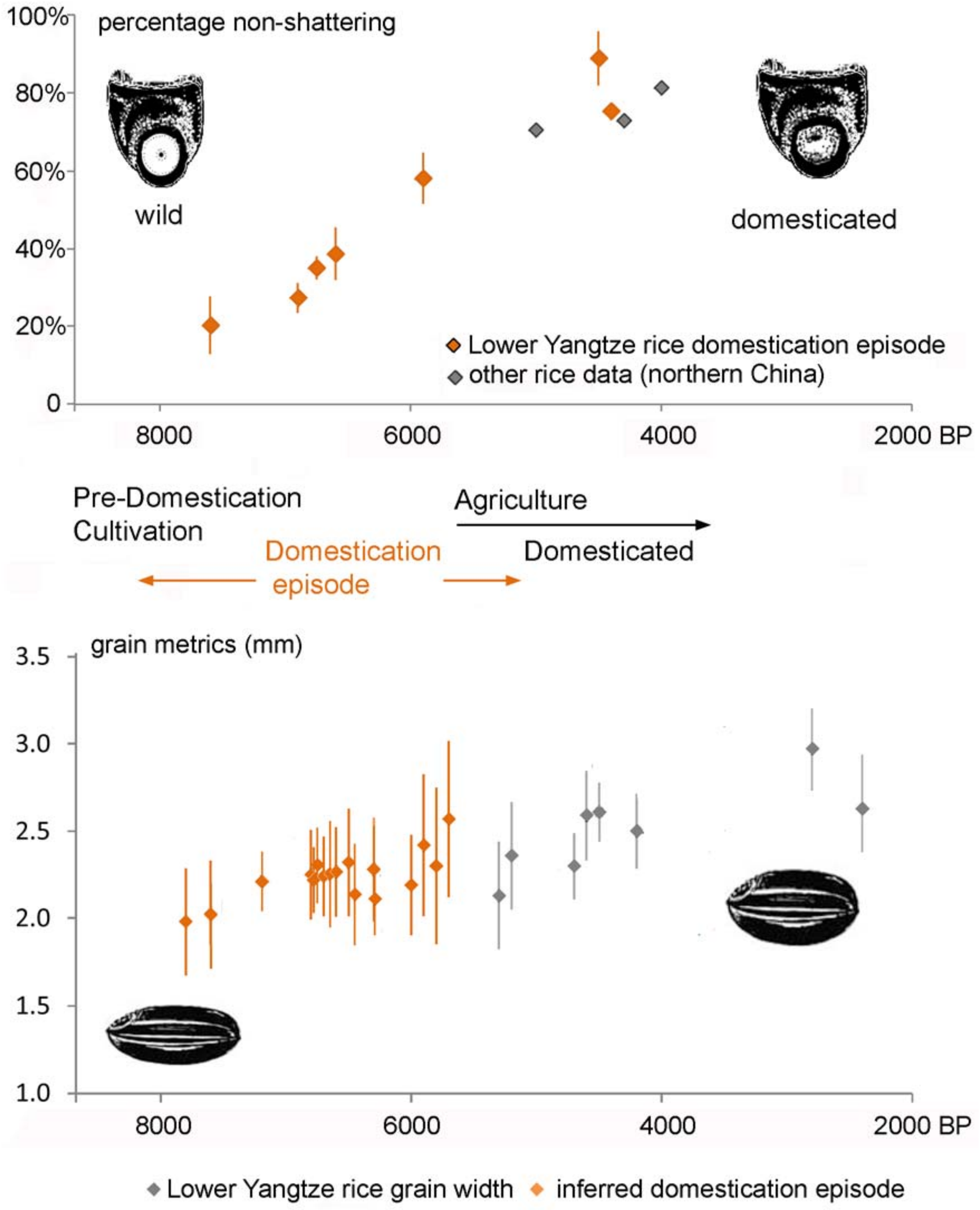

Figure 2. Illustration of episodes of evolution of domestication in Lower Yangtze rice, including percentage of non-shattering (top) and grain width (bottom) (after Fuller, 2014).

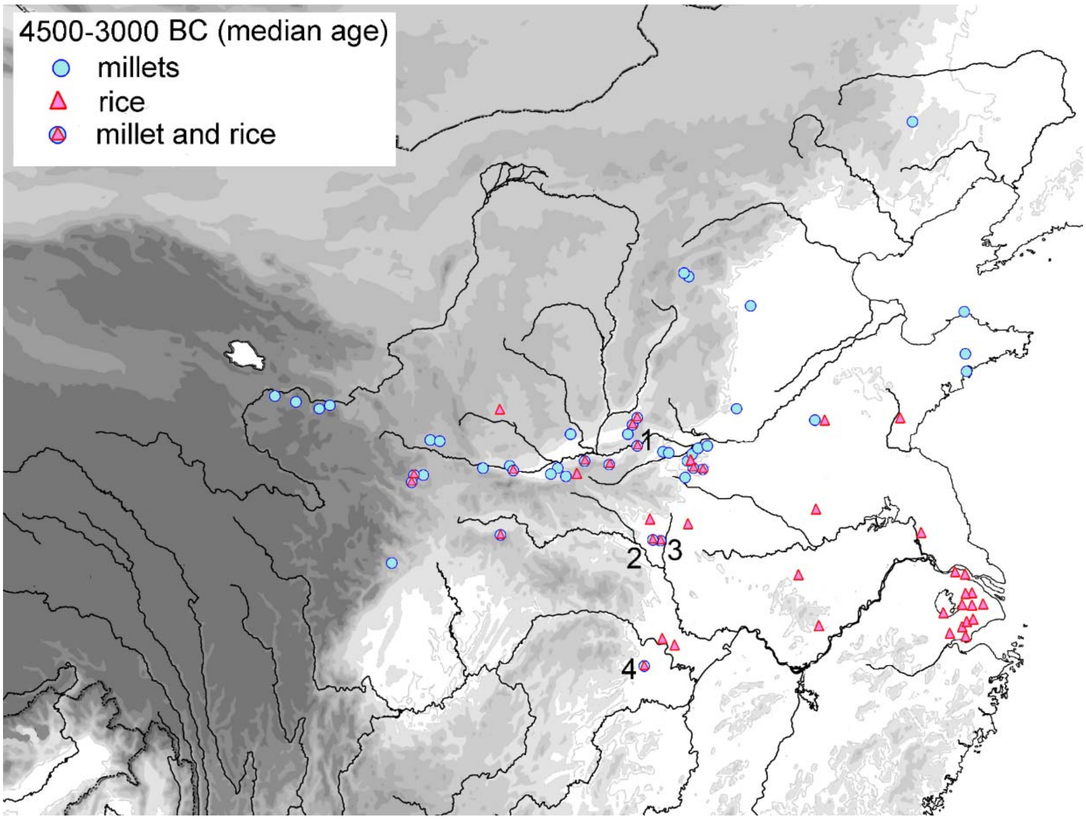

Figure 3. Distribution of sites with archaeobotanical finds of millet and/or rice with median ages between 4500 and 3000 BC. Selected sites with both millet and rice labelled: (1) Nanjiaokou; (2) Baligang; (3) Huitupo; (4) Chengtoushan.

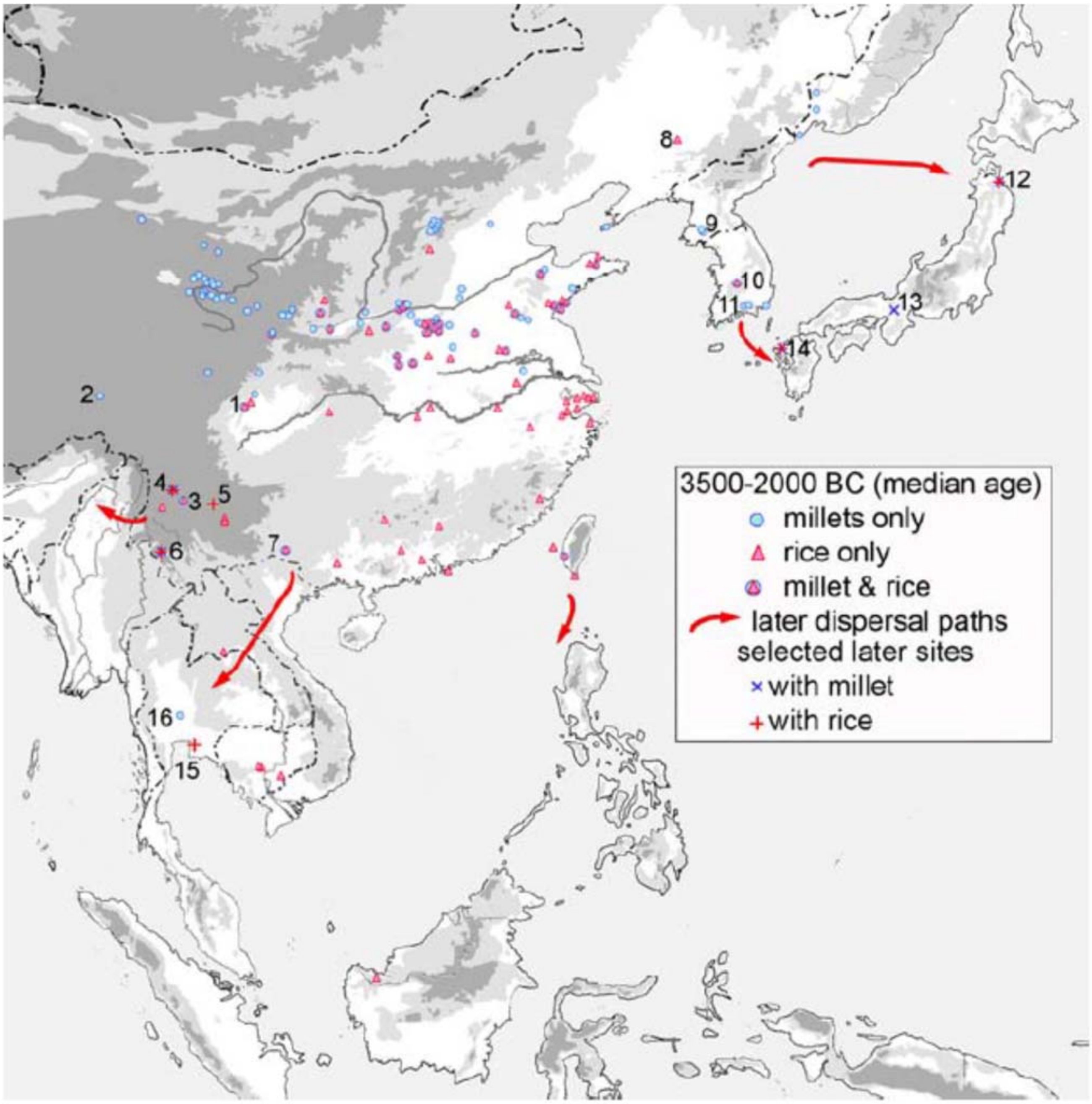

Figure 4. Distribution of sites with archaeobotanical finds of millet and/or rice with median ages between 3500 and 2000 BC. Selected sites labelled: (1) Baodun, (2) Qamdo Karuo, (3) Baiyancun, (4) Haimenkou, (5) Dadunzi, (6) Shifodong, (7) Gantouyan, (8) Wenjiatun, (9) Jitap-ri and Masan-ri, (10) Daechonri [problematic], (11) Oun and Sangchon B, (12) Kazahari, (13) Ryugasaki, (14) Nabatake (ca. 850 BC), (15) Khok Phanom Di, (16) Non Pa Wai.

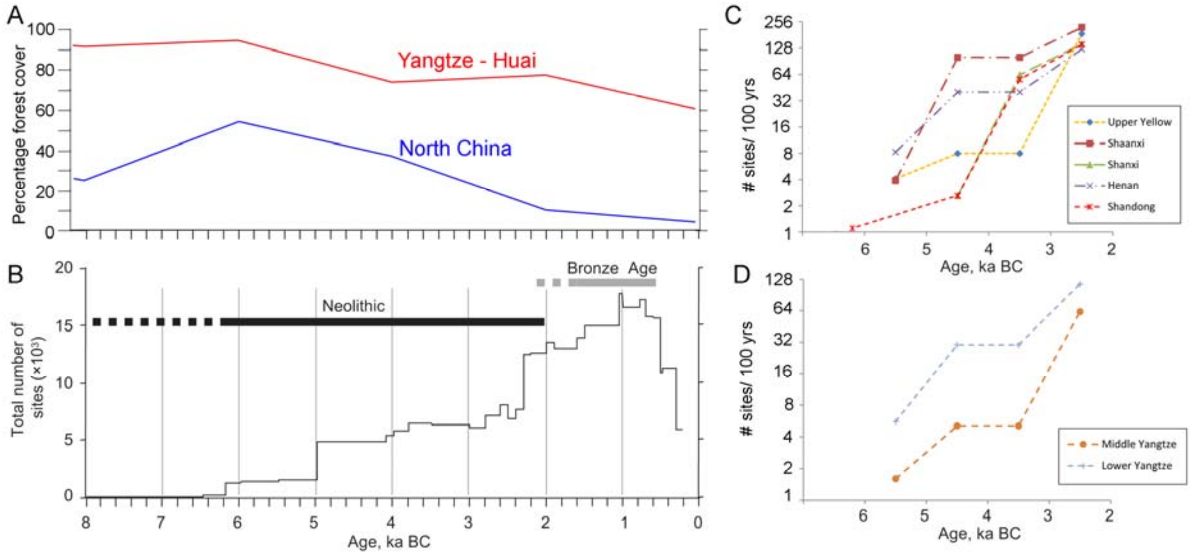

Figure 5. Proxies for demographic change: (A) deforestation trends estimated from regional pollen databases (after Ren, 2007); (B) total increase in recorded archaeological sites across north China (after Wagner et al., 2013); (C) regional site counts per century, geometric scale (Upper Yellow River data from Li et al., 2009; others from Wagner et al., 2013); (D) regional site counts per century, geometric scale (data from Li et al., 2009).

Site	Province	Local Script	Culture	C14 Material	Code	Date	Median	Calibrated 2 sigma	Comments	Crops	Cultivation Tools	References
HENAN												
Peiligang	Henan	裴李岗	Peiligang	Mixed Charcoal	ZK-0572	9037±1000 BP	8635	11170-6100 cal. BC	Date rejected error margin too large and mixing of charcoal from different trenches; likely old wood problems and potential clay contamination.	Cited as Setaria. Question as to security of identification	spades	Lu (1999, table 4)
Peiligang	Henan	裴李岗	Peiligang	Mixed Charcoal	ZK-0434	7662±480 BP	6680	7730-5630 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl. Date is probably unreliable. Very large error margin and notably quite early; likely old wood.	As above	As above	Zhang and Hung (2013, table 2)
Peiligang	Henan	裴李岗	Peiligang	Charcoal	ZK-0754	7234±200 BP	6100	6470-5730 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl	As above	As above	Zhang and Hung (2013, table 2)
Peiligang	Henan	裴李岗	Peiligang	Charcoal	ZK-0571	6967±105 BP	5845	6030-5660 cal. BC	NB: Dates cited in Zhang and Hung (2013, Table 2) is 5730 half-life.	As above	As above	Zhu (2013); Lu (1998; 1999, table 4)
Peiligang	Henan	裴李岗	Peiligang	Charcoal	ZK-0753	6981±200 BP	5880	6250-5510 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl	As above	As above	Zhang and Hung (2013, table 2)
Peiligang	Henan	裴李岗	Peiligang	Charcoal	ZK-0751	6253±215 BP	5170	5620-4720 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl	As above	As above	Zhang and Hung (2013, table 2)
Shawoli	Henan	沙窝李	Peiligang	Charcoal	ZK-1130	6967±105 BP	5845	6030-5660 cal. BC	NB: Dates cited in Zhang and Hung (2013, Table 2) is 5730 half-life.	Setaria	spades	Wang (1984); Lu (1998; 1999, table 4); Chen (1994); Zhang and Hung (2010); Zhu (2013)
Dingzhuang	Henan	丁庄	Peiligang	No date			est. 6000	est. 7000-5000 BC	Ceramic typology Peiligang	Setaria	?	Song 2011
Fudian	Henan	府店	Peiligang	No date			est. 5500	est. 6000-5000 BC	Ceramics - Late Peiligang Culture	Setaria (small)	?	Lee et al. 2007; Bestel et al. 2014
Wuluoxipo	Henan	坞罗西坡	Peiligang	Charcoal	Beta-404827	6360±30 BP	5350	5470-5230 cal. BC		Setaria	spades	Zuo et al. (2016); Lee et al. 2007
Wuluoxipo	Henan	坞罗西坡	Peiligang	phytolith	Beta-404848	6350±30 BP	5345	5470-5220 cal. BC		Setaria	spades	Zuo et al. (2016); Lee et al. 2007
Shigu	Henan	石固	Peiligang	Charcoal	WB79-60	7239±90 BP	6140	6360-5920 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl	Wild foods. No grains. But has cultivation tools	spades	Liu and Chen (2012); see also Zhang and Hung (2013)
Shigu	Henan	石固	Peiligang	Charcoal	WB80-15	7088±85 BP	5975	6200-5750 cal. BC	As above	As above	As above	Liu and Chen (2012); see also Zhang and Hung (2013)
Shigu	Henan	石固	Peiligang	Charcoal	WB80-17	6811±85 BP	5730	5900-5560 cal. BC	As above	As above	As above	Liu and Chen (2012); see also Zhang and Hung (2013)
Shuiquan	Henan	水泉	Peiligang	Charcoal	ZK-2345	7064±120 BP	5965	6210-5720 cal. BC	Ceramics - Late Peiligang Culture	Possible Setaria	spades	Lu (1999, table 4)
Shuiquan	Henan	水泉	Peiligang	Charcoal	ZK-2344	6900±110 BP	5810	6000-5620 cal. BC	As above	As above	As above	Lu (1999, table 4)
E’gou Beigang	Henan	莪沟北岗	Peiligang	Charcoal	ZK-580	7035±80 BP	5895	6050-5740 cal. BC	Dates from Lu (2000)	Just wild foods	spades	Lu (1999, table 4)
E’gou Beigang	Henan	莪沟北岗	Peiligang	Charcoal	WB-7839	7060±160 BP	5940	6240-5640 cal. BC	Dates from Lu (2000)	As above	As above	Lu (1999, table 4)
E’gou Beigang	Henan	莪沟北岗	Peiligang	Charcoal	WB-7838	6778±100 BP	5700	5890-5510 cal. BC	Dates from Lu (2000)	As above	As above	Lu (1999, table 4)
E’gou Beigang	Henan	莪沟北岗	Peiligang	Charcoal	WB-7817	7083±120 BP	5975	6220-5730 cal. BC	Date taken from Zhang and Hung (2013, table 2), amended to 5568 hl	As above	As above	Zhang and Hung (2013, table 2)
HEBEI												
Niuwabao	Hebei	牛洼堡	Cishan	No date				6500-5000 cal. BC	Reported millet "piles" as seen at Cishan. See below	reported "millet" no formal identification	?	Ren (1996)
Cishan	Hebei	磁山	Cishan	Stated as "grain" but more likely sediment containing phytoliths	GZ1979-1982 +CNL188	9212±77 BP to 6708±48 BP	7080	8620-5540 cal. BC	Nine dates reported on millet grains have been dismissed. No flotation was conducted at the site and it is therefore questionable where the source of carbon for dating derived from. Dates span almost 3000 years and from single features are not statistically contemporary. Possibly phytolith rich sediments.	Setaria and Panicum identified from phytoliths. However, no charred grains have been recovered or identified	spades	Lu et al. (2009, fig 3)
Cishan	Hebei	磁山	Cishan	Charcoal	ZK-0439	7147±100 BP	6025	6240-5810 cal. BC	Three charcoal dates suggest a date of around 5800-6000 BC and are consistent with unpublished new dates. NB. This date is reported using the incorrect 5730 half-life within Lu et al. 2009.	As above	spades	Lu (1999, table 4); Lu et al. (2009, fig 3)
Cishan	Hebei	磁山	Cishan	Charcoal	ZK-0440	7030±100 BP	5895	6080-5710 cal. BC	As above	As above	spades	Lu (1999, table 4); Lu et al. (2009, fig 3)
Cishan	Hebei	磁山	Cishan	Charcoal	BK-78029	6860±100 BP	5800	5990-5610 cal. BC	As above	As above	spades	Lu (1999, table 4); Lu et al. (2009, fig 3)
Cishan	Hebei	磁山	Cishan	Unknown					New repeat dates by Wu Xiaohong cited in Zhang and Hung (2013)	As above	spades	Zhang and Hung (2013, table 2)
Beifudi	Hebei	北福地	Cishan	Charcoal	BK2004001	7100±55 BP	5400	5480-5320 cal. BC	Dates are consistent but possibly slightly younger than Cishan e.g. 5500 to 6000 BC	No flotation	spades	Li et al. (2011)
Beifudi	Hebei	北福地	Cishan	Charcoal	BA04444	6990±30 BP	5405	5510-5300 cal. BC	As above	As above	spades	Li et al. (2011)
Beifudi	Hebei	北福地	Cishan	Charcoal	BA03419	6440±60 BP	5885	5990-5780 cal. BC	As above	As above	spades	Li et al. (2011)
Beifudi	Hebei	北福地	Cishan	Charcoal	BA04252	6430±40 BP	5955	6070-5840 cal. BC	As above	As above	spades	Li et al. (2011)
SHANGDONG												
Yuezhuang	Shandong	月庄	Houli	Rice grains	TO-11865	7050±80 BP	5905	6060-5750 cal. BC	Houli Culture the dates are broadly contemporary with Cishan. Millets are seen to be in early stages of cultivation (Crawford et al. 2016).	Mainly Panicum and Oryza, but some Setaria; unclear if rice is cultivated/domesticated.	Possible cultivation tools are known for Houli sites. But low in number.	Crawford et al. (2006; 2016)
Yuezhuang	Shandong	月庄		Millet Grains	BA-8168	6900±35 BP	5795	5880-5710 cal. BC	As above. Direct dates on *Panicum*	as above	As above	Crawford et al. (2006; 2016)
Xihe	Shandong	西河	Houli	Rice grain (H358)	BA10679	7090±30 BP	5965	6030-5900 cal. BC	As above	Oryza x74, Setaria x2. Unclear if rice is cultivated/domesticated	See comment above	Jin, G. et al. (2014)
Xihe	Shandong	西河	Houli	Rice grain (H358)	BA10680	7115±30 BP	5985	6060-5910 cal. BC	As above	As above	See comment above	Jin, G. et al. (2014)
Xihe	Shandong	西河	Houli	Rice grain (H358)	BA10681	7165±30 BP	6035	6080-5990 cal. BC	As above	As above	See comment above	Jin, G. et al. (2014)
Xihe	Shandong	西河	Houli	Rice grain (H358)	BA10682	7165±25 BP	6030	6070-5990 cal. BC	As above	As above	See comment above	Jin, G. et al. (2014)
Xihe	Shandong	西河	Houli	Grape (H305)	BA10683	7085±30 BP	5960	6020-5900 cal. BC	As above	As above	See comment above	Jin, G. et al. (2014)
Xihe	Shandong	西河	Houli	Grape (H305)	BA10686	7120±30 BP	5990	6060-5920 cal. BC	As above	As above	See comment above	Jin, G. et al. (2014)
Nantunling	South Shandong	南屯岭	Late Beixin	Not C14 dated			4750	5000-4500 cal. BC	Site represents early millet finds after gap of a millenia	2 Setaria, 3 Panicum	See comment above	Chen 2007; Underhill et al. 2008
Zhangmatun	Shandong	张马屯	Early Houli	Grape (T0113)	BA10698	8000±30 BP	6935	7060-6810 cal. BC	The same sample with grape and millets has probable intrusive wheat grains. Dates appear at least 500 years older than Houli culture and 1000 years older than Xihe and Yuezhuang	2 Setaria 6 Panicum. No rice. As the wheat grains are intrusive the millet grains should be regarded with caution	No obvious cultivation tools	Wu et al. (2014)
Zhangmatun	Shandong	张马屯	Early Houli	Grape (T0113)	BA10697	8050±30 BP	6950	7080-6820 cal. BC	As above	As above	No obvious cultivation tools	Wu et al. (2014)
Zhangmatun	Shandong	张马屯	Early Houli	Grape (T0113)	BA10693	7965±35 BP	6875	7050-6700 cal. BC	As above	As above	No obvious cultivation tools	Wu et al. (2014)
Zhangmatun	Shandong	张马屯	Early Houli	Grape (T0113)	BA10694	7820±30 BP	6665	6740-6590 cal. BC	As above	As above	No obvious cultivation tools	Wu et al. (2014)
INNER MONGOLIA												
Xinglonggou	Inner Mongolia	兴隆沟	Xinglongwa	Panicum	not given	not given	5690	5720-5660 cal. BC	The uncalibrated date is not available - and there is some variability to how it is quoted. However, it is one of the few direct dates on millet grains.	Mainly Panicum, some setaria. Millet remains are sparse in many contexts comparatively to wild food remains	Present	Zhao, Z (2011)

Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	bone; house 2	ZK-1389	5499±170 BP	4340	4710-3970 cal. BC	Dates quoted by Shelach and Teng (2013) and Lu (1998) are 5730 half-life. Dates here are corrected to the 5568 half life. Date too young.	Isotope data suggests that millet consumption is indirect e.g. through consumption of millet eating animals (see Hu et al. 2008).	Stone tools present. Regarded as more "hoe like" than "spade like" compared to tools of Peiligang Culture	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 119	ZK-1390	6700±205 BP	5625	6020-5230 cal. BC	As above dates here are corrected to the 5568 half life. Date broadly contemporary with Xinglonggou.	As above	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 119	ZK-1391	7258±115 BP	6155	6400-5910 cal. BC	As above dates here are corrected to the 5568 half life. Date regarded as probable old charcoal. It is from the same house infill as two younger dates.	As above	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 119	ZK-1392	7035±95 BP	5895	6070-5720 cal. BC	As above dates here are corrected to the 5568 half life. Broadly contemporary with Xinglonggou	As above	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 121	ZK-1393	6768±95 BP	5695	5880-5510 cal. BC	As above dates here are corrected to the 5568 half life. Date broadly contemporary with Xinglonggou.	As above	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 133	ZK-1394	5699±90 BP	4540	4730-4350 cal. BC	As above dates here are corrected to the 5568 half life. Dates are too young	As above	As above	Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal; house 142	ZK-2064	5572±85 BP	4430	4610-4250 cal. BC	As above dates here are corrected to the 5568 half life. Dates are too young.	As above	As above	Lu (1999, table 2)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal	ZK-3070	6504±48 BP	5460	5560-5360 cal. BC	As above dates here are corrected to the 5568 half life. Date broadly contemporary with Xinglonggou.	As above	As above	Shelach and Teng (2013, table 3.1)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal	ZK-3074	5271±53 BP	4105	4240-3970 cal. BC	As above dates here are corrected to the 5568 half life. Dates are too young.	As above	As above	Shelach and Teng (2013, table 3.1)
Xinglongwa	Inner Mongolia	兴隆洼	Xinglongwa	charcoal	ZK-3075	4987±54 BP	3800	3950-3650 cal. BC	As above dates here are corrected to the 5568 half life. Dates are too young.	As above	As above	Shelach and Teng (2013, table 3.1)
Zhaobaogou	Inner Mongolia	趙宝溝	Zhaobaogou	charcoal	ZK-2135	6034±95 BP	4965	5210-4720 cal. BC	Dates quoted by Shelach and Teng (2013); Lu (1998) are all at 5730 half-life. Dates here are corrected to the 5568 half life.	No flotation	Stone cultivation tools present.	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Zhaobaogou	Inner Mongolia	趙宝溝	Zhaobaogou	charcoal	ZK-2136	6044±95 BP	4970	5220-4720 cal. BC	As above dates here are corrected to the 5568 half life.	No flotation	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Zhaobaogou	Inner Mongolia	趙宝溝	Zhaobaogou	charcoal	ZK-2137	5980±95 BP	4915	5210-4620 cal. BC	As above dates here are corrected to the 5568 half life.	No flotation	As above	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Baiyinchanghan	Inner Mongolia	白音长汗	Xinglongwa	charcoal	WB-90-2	6840±100 BP	5770	5980-5560 cal. BC	Dates quoted by Shelach and Teng (2013) may be quoted at 5730 half-life (as suggested by dates given in Barton 2009). Dates are therefore corrected to the 5568 half life. Broadly contemporary with Xinglonggou/Xinglongwa	Starch analysis revealed millet starch	Present	Shelach and Teng (2013, table 3.1)
Baiyinchanghan	Inner Mongolia	白音长汗	Xinglongwa	charcoal	WB-90-1	6403±85 BP	5370	5530-5210 cal. BC	As above. Broadly contemporary/ slightly younger than Xinglonggou/Xinglongwa	as above	Present	Shelach and Teng (2013, table 3.1)
Chahai	Inner Mongolia	查 海	Xinglongwa	charcoal	ZK-2138	6729±95 BP	5645	5810-5480 cal. BC	Dates quoted by Shelach and Teng (2013); Lu (1998) are all at 5730 half-life. Dates here are corrected to the 5568 half life. Broadly contemporary with other Xinglongwa sites	No flotation	Present	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Chahai	Inner Mongolia	查 海	Xinglongwa	charcoal	BA-93001	7151±150 BP	6045	6360-5730 cal. BC	As above	No flotation	Present	Shelach and Teng (2013, table 3.1); Lu (1999, table 2)
Nantaizi	Inner Mongolia	南台子	Xinglongwa	No date				est. 6000-4000 BC	dated by material culture	No flotation	Present	Shelach and Teng (2013, table 3.1)
GANSU												
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134422	6615±35 BP	5555	5620-5490 cal. BC	from Barton et al. (2009)	Panicum only	very small number of cultivation tools	Barton et al. (2009)
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134423	6645±30 BP	5575	5630-5520 cal. BC	from Barton et al. (2009)	Panicum only	As above	Barton et al. (2009)
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134424	6580±30 BP	5550	5620-5480 cal. BC	from Barton et al. (2009)	Panicum only	As above	Barton et al. (2009)
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134427	6280±30 BP	5265	5320-5210 cal. BC	from Barton et al. (2009)	Panicum only	As above	Barton et al. (2009)
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134452	6720±40 BP	5640	5720-5560 cal. BC	from Barton et al. (2009)	Panicum only	As above	Barton et al. (2009)
Dadiwan	Gansu	大地湾	Dadiwan	bone collagen	CAMS 134453	6690±40 BP	5600	5680-5520 cal. BC	from Barton et al. (2009)	Panicum only	As above	Barton et al. (2009)
Qin'an I	Gansu	秦安	Dadiwan	No date				est. 6000-5500 BC	Li et al. (2015). No C14 date given. Figure 6 indicates the site is contemporary with Dadiwan I	Panicum only	?	Li et al. (2015)
Qin'an II	Gansu	秦安	Dadiwan	No date				est. 4300-4000 BC	Date is broadly given as Banpo period.	Panicum and Setaria	?	Li et al. (2015)
Qin'an QA10	Gansu	秦安	Late Banpo Yangshao	Panicum milaceum	CAMS 128457	4965±40 BP	3790	3930-3650 cal. BC	Dates of sites in Gansu suggest a hiatus between the Dadiwan and Banpo periods	Panicum and Setaria	?	Ji (2009); Li et al. (2015)
Qin'an QA10	Gansu	秦安	Late Banpo Yangshao	charcoal	CAMS 128100	5080±30 BP	3875	3960-3790 cal. BC	Dates of sites in Gansu suggest a hiatus between the Dadiwan and Banpo periods	Panicum and Setaria	?	Ji (2009); Li et al. (2015)
Lixian LX12/LX002 Heituya	Gansu	礼县 LX12	Banpo Yangshao	charcoal	CAMS 94205	5360±35 BP	4190	4330-4050 cal. BC	The same date CAMS 94205 is given in Barton (2009) for LX002 and in Ji (2009) for LX12	Panicum and Setaria	?	Ji (2009); Barton (2009); Bettinger et al. (2005)

Site	Province	Local Script	Culture	C14 Material	Code	Date	Median	Calibrated	Comments	Crops	Cultivation Tools	References
LOWER YANGTZE												
Shangshan	Zhejiang	上山	Shangshan	Charcoal pottery temper	BA02236	9610±160 BP	8945.5	9399-8492 cal. BC	Charcoal dates from the site often appear younger in date, raising the question of clay contamination on pottery dates. In particular this date appears considerably earlier and has been dimissed.	Rice remains in pottery. Status is unclear as wild, early stages of domestication/cultivation	No definitive cultivation tools have been identified. But the site is not waterlogged	Jiang and Liu (2006); Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Shangshan	Zhejiang	上山	Shangshan	Charcoal pottery temper	BA02235	8740±110 BP	7897	8205-7589 cal. BC	As above. Date dismissed.	As above	As above	Jiang and Liu (2006); Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Shangshan	Zhejiang	上山	Shangshan	Charcoal pottery temper	BA02237	8620±160 BP	7790.5	8223-7358 cal. BC	As above. Date dismissed.	As above	As above	Jiang and Liu (2006); Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Shangshan	Zhejiang	上山	Shangshan	Charcoal pottery temper	BA06136	8855±40 BP	8015.5	8215-7816 cal. BC	As above. Date dismissed.	As above	As above	Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Shangshan	Zhejiang	上山	Shangshan	Charcoal	BA06137	8180±35 BP	7190	7306-7074 cal. BC	This date on charcoal is considerably younger than those on pottery, and raises questions as to the reliability of dates obtained from pottery temper.	As above	As above	Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Shangshan	Zhejiang	上山	Shangshan	Charcoal (pottery temper)	BA02238	8050±110 BP	6987	7315-6659 cal. BC	This date is broadly contemporary with charcoal date above.	As above	As above	Jiang and Liu (2006); Pan (2011); Long and Taylor (2015); Zheng and Jiang (2007)
Huxi	Zhejiang	湖西	Shangshan	charcoal	BA30136	7740±30 BP	6566.5	6641-6492 cal. BC	Dates for Shangshan Culture from this site on short-lived material are significantly later than the Shangshan pottery dates above. Dates possibly mark start of rice cultivation.	rice grains domesticated spikelet types may account for ?8.7%. But the criteria used do not follow that outlined by Fuller et al. (2009), so direct comparison is unclear.	Not recorded	Zheng et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	charcoal	BA30138	7730±30 BP	6557	6632-6482 cal. BC	As above	As above	Not recorded	Zheng et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	charcoal	BA30140	7605±30 BP	6459	6497-6421 cal. BC	As above	As above	Not recorded	Zheng et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	charcoal	BA30141	7630±30 BP	6496.5	6564-6429 cal. BC	As above	As above	Not recorded	Zheng et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	charcoal	BA30139	7915±45 BP	6841	7029-6653 cal. BC	This date is from the lowest part of a sequence but not statisically contemporary with dates only marginally above or other dates from the site. As such it should be regarded with caution.	As above	Not recorded	Zheng et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	Phytoliths	Beta-406654	7680±30 BP	6527	6591-6463 cal. BC	Date is broadly contemporary with other dates from the site.	As above	Not recorded	Zuo et al. (2016)
Huxi	Zhejiang	湖西	Shangshan	Plant remains	Beta-407469	7820±30 BP	6664	6736-6592 cal. BC	While broadly contemporary this date is a little older than all but one other date from the site.	As above	Not recorded	Zuo et al. (2016)
Hehuashan	Zhejiang	荷花山	Shangshan	rice	no information		6900	7350-6450 cal. BC	Date is estimated from Shangshan Culture dates from Huxi and Shangshan and on unpublsihed C14 dates reported at 7000 BC.	Remains of rice rachises, charred grains and phytoliths,	Not recorded	IA CASS 2013
Xiaohuangshan	Zhejiang	小黄山	Shangshan/Kuahuqiao	Est. date/ Unclear if C14 are available			6500	7000-6000 cal. BC	As with Huxi there is a suggestion that the the dates of Shanshang Culture are younger than many of the dates from Shanshang site.	Rice grains, phytoliths and husks within pottery paste tempers as seen also at Shangshan	Not recorded	Zhang et al. (2005); Zheng and Jiang (2007); Liu and Chen (2012, 67).
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	acorns	HL91001	7076±155 BP	5955	6250-5660 cal. BC	Date on short lived species suggest earliest deposits date from around 6000 to 5500 BC.	Rice grains appear to be within the very early stages of domestication; Zheng et al (2007) overestimate domesticates by including immature	The site has a few tools preserved including wooded hoes and animal bone scapular spades	Long and Taylor (2015); Pan (2011); See Shelach-Lavi (2015; Figure 78)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	acorns	BA9906	6800±170 BP	5710	6040-5380 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	Leaf	GZ1315	6783±32 BP	5680	5730-5630 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	Wood-Canoe	ZK3173	6991±50 BP	5870	5990-5750 cal. BC	Dates broadly consistent suggesing occupation between 6000-5500 BC	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	Wood-Canoe	BK2003006	7070±155 BP	5950	6250-5650 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK2003007	7055±90 BP	5905	6080-5730 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BA08367	6515±40 BP	5465	5560-5370 cal. BC	As above	As above	As above	Shu et al. (2010)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BA08366	6715±40 BP	5635	5720-5550 cal. BC	As above	As above	As above	Shu et al. (2010)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BA08365	6925±45 BP	5845	5970-5720 cal. BC	As above	As above	As above	Shu et al. (2010)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	ZK3172	6919±46 BP	5840	5970-5710 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	ZK3174	6886±65 BP	5805	5970-5640 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK200168	6615±110 BP	5545	5730-5360 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK200165	6585±90 BP	5515	5670-5360 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	HL91023	6500±176 BP	5400	5750-5050 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK200167	6450±90 BP	5415	5610-5220 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK200170	6375±120 BP	5330	5610-5050 cal. BC	As above	As above	As above	Long and Taylor (2015); Pan (2011)
Kuahuqiao	Zhejiang	跨湖桥	Kuahuqiao	wood	BK200169	6180±90 BP	5090	5330-4850 cal. BC	Date appears younger	As above	As above	Long and Taylor (2015); Pan (2011)
Luojiajiao	Zhejiang	罗家角	Majiabang	reed	BK80004	6200±100 BP	5125	5400-4850 cal. BC	Converted from 5730 to 5568 half-life. The site appears earlier than Tianloushan and probably Hemudu.	Rice spikelet bases with minority domesticated; Zheng et al (2007) overestimate domesticates by including immature	Four fragments of bone scapula spades were recorded.	Lu 1999 (table 7(2); Zheng et al. 2007; Xie et al. 2015
Luojiajiao	Zhejiang	罗家角	Majiabang	reed	ZK860	6080±130 BP	5025	5350-4700 cal. BC	As above	As above	As above	Lu 1999 (table 7(2); Zheng et al. 2007; Xie et al. 2015
Hemudu	Zhejiang	河姆渡	Hemudu	Twig, acorn	BK78104	6130±170 BP	5085	5470-4700 cal. BC	While date appears older, large error margin brings it in line with other dates	Rice grains. Assumed to be similar in stage of doemstication process to Tianluoshan below.	Has bone spades and hoes	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	Acorn	PV0047	6080±130 BP	5015	5320-4710 cal. BC	Dates generally in line with Fuller et al. (2011). Only dates on short lived material are included here.	As above	As above	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	Rice husks	BK78114	6060±100 BP	4975	5230-4720 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	rice husks	ZK0263	5890±120 BP	4760	5060-4460 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	Wooden pole	BK78111	5880±100 BP	4750	5000-4500 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	Twig, grass	BK78103	5740±90 BP	4580	4790-4370 cal. BC	Dates generally in line with Wu et al. (2011). Only dates on short lived material are included here.	As above	As above	Zhejiang Province Institute (2003); Pan (2011)
Hemudu	Zhejiang	河姆渡	Hemudu	Foxnut	BA06594	5990±40 BP	4890	5000-4780 cal. BC	Dates generally in line with those done earlier. However 3 of the newer charcoal dates (not included) were notably early and serve to demonstrate the old charcoal effect	As above	As above	Zhejiang Province Institute (2003); Wu et al. 2011
Hemudu	Zhejiang	河姆渡	Hemudu	Water chestnut	BA06593	5985±40 BP	4890	5000-4780 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Wu et al. 2011
Hemudu	Zhejiang	河姆渡	Hemudu	Water chestnut	BA06592	5840±40 BP	4690	4800-4580 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Wu et al. 2011
Hemudu	Zhejiang	河姆渡	Hemudu	Rice	BA06595	5790±40 BP	4650	4770-4530 cal. BC	As above	As above	As above	Zhejiang Province Institute (2003); Wu et al. 2011

Hemudu	Zhejiang	河姆渡	Hemudu	Acorn	BA06596	5300±40 BP	4125	4260-3990 cal. BC	Date appears too young.	As above	As above	Zhejiang Province Institute (2003); Wu et al. 2011
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK75057	6130±40 BP	5075	5350-4800 cal. BC	Date appears slightly older	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK78101	5890±100 BP	4755	5010-4500 cal. BC	Dates in line with other dates	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK78102	5870±100 BP	4740	4990-4490 cal. BC	Dates in line with other dates	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	sediment	BK78109	6080±200 BP	5000	5500-4500 cal. BC	Date appears slightly older.	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK78115	5770±85 BP	4635	4830-4440 cal. BC	Dates in line with other dates	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK78116	6050±85 BP	4980	5220-4740 cal. BC	Date appears slightly older	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	ZK 0590	6020±85 BP	4965	5210-4720 cal. BC	Date appears slightly older	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	BK78119	6020±100 BP	4975	5250-4700 cal. BC	Date appears slightly older	As above	As above	Zhejiang Province Institute (2003)
Hemudu	Zhejiang	河姆渡	Hemudu	wood	WB 77-01	5810±100 BP	4680	4910-4450 cal. BC	Dates in line with other dates	As above	As above	Zhejiang Province Institute (2003)
Tianluoshan	Zhejiang	田螺山	Hemudu	Scirpus planiculmis	BA07763	6045±45 BP	5000	5200-4800 cal. BC	rice half-way towards domesticatation	rice, wild still prominent, along with immature and domesticated. Roughly equal quantities	Has bone and wooden spades, hoes and dibble sticks.	Zheng et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	Scirpus planiculmis	BA07764	5785±60 BP	4635	4780-4490 cal. BC	As above	As above	As above	Zheng et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	Scirpus triangulatus	BA08527	5725±40 BP	4575	4690-4460 cal. BC	As above	As above	As above	Zheng et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	Trapa natans nut	BA06593	5985±40 BP	4880	4990-4770 cal. BC	As above	As above	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	Euryale ferox seed	BA06594	5990±40 BP	4890	5000-4780 cal. BC	As above	As above	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	Trapa natans nut	BA06592	5840±40 BP	4690	4800-4580 cal. BC	As above	As above	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	chared rice grain	BA06595	5790±40 BP	4630	4730-4530 cal. BC	As above	As above	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	acorn	BA06596	5300±40 BP	4125	4260-3990 cal. BC	Later level.	Possibly more domesticated rice, but few plant remains	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	wood	BK2004028	5081±66 BP	3845	3990-3700 cal. BC	Later level.	As above	As above	Fuller et al. (2009)
Tianluoshan	Zhejiang	田螺山	Hemudu	wood	BK2004030	6949±73 BP	5850	5990-5710 cal. BC	Old wood from lowest occupation. Dismissed	As above	As above	Sun Guoping, pers. comm.
Tianluoshan	Zhejiang	田螺山	Hemudu	wood	BK2004027	6711±90 BP	5615	5760-5470 cal. BC	Old wood from lowest occupation. Dismissed	As above	As above	Sun Guoping, pers. comm.
Caoxieshan	Jiangsu	草鞋山	Majiabang	rice grain	BA08905	5005±35 BP	3825	3950-3700 cal. BC	Domesticated type rachis account for between 60-80% of the assemblage	Rice grains and spikelet bases. Rice appears near fully domesticated	Unknown.	Fuller et al. (unpublished); Fuller and Qin (2009); Fuller et al. 2014
Caoxieshan	Jiangsu	草鞋山	Majiabang	rice grain frag.	BA08906	5060±35 BP	3865	3960-3770 cal. BC	As above	As above	As above	Fuller et al. (unpublished); Fuller and Qin (2009)
Caoxieshan	Jiangsu	草鞋山	Majiabang	wood charcoal	BA08907	5115±35 BP	3890	3990-3790 cal. BC	As above	As above	As above	Fuller et al. (unpublished); Fuller and Qin (2009)
Caoxieshan	Jiangsu	草鞋山	Majiabang	wood charcoal	ZK-0201	5460±115 BP	4270	4540-4000 cal. BC	Date demonstrates problems of old wood when dating charcoal. Date dismissed.	As above	As above	Wasano (1995); Fuller et al. (unpublished)
Caoxieshan	Jiangsu	草鞋山	Majiabang	wood charcoal	ZK-0202	5210±105 BP	4055	4330-3780 cal. BC	As above	As above	As above	Wasano (1995); Fuller et al. (unpublished)
Caoxieshan	Jiangsu	草鞋山	Majiabang	wood charcoal	BK76022	5220±110 BP	4060	4330-3790 cal. BC	As above	As above	As above	Wasano (1995); Fuller et al. (unpublished)
Yangjia	Jiangsu	杨家	Majiabang	rice grain	BA131756	5340±30 BP	4185	4320-4050 cal. BC	Broadly contemporary with Caoxieshan also of Majiabang Culture	rice dominated seed assemblage; also phytoliths	Not recorded	Qiu et al (2016)
Yangjia	Jiangsu	杨家	Majiabang	rice grain	BA131757	5265±45 BP	4110	4240-3980 cal. BC	As above	As above	As above	Qiu et al (2016)
HUAI RIVER VALLEY												
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7640±30 BP	6500	6570-6430 cal. BC	The site lies in the NW of Jiangsu in the middle to lower Huai Valley. It is assumed that the dates are based 5568 half-life making it contemporary with Shangshan Culture at Huxi.	rice grains and phytoliths	No identified cultivation tools	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7660±30 BP	6520	6590-6450 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7640±30 BP	6500	6570-6430 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7460±30 BP	6325	6410-6240 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charcoal	not reported	7350±40 BP	6215	6360-6070 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7035±35 BP	5920	6000-5840 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charcoal	not reported	7427±31 BP	6310	6390-6230 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charcoal	not reported	7237±35 BP	6115	6210-6020 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charcoal	not reported	6870±30 BP	5755	5840-5670 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7470±40 BP	6335	6430-6240 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shunshanji	Jiangsu	顺山集	Shushanji	charred rice	not reported	7325±40 BP	6160	6260-6060 cal. BC	As above	As above	As above	Nanjing Museum and Jiangsu Province Institute (2016)
Shuangdun	Anhui	双墩村	Shuangdun	charcoal	not available		5215	5380-5050 cal. BC	Date is quoted as 7330 to 7000 years old, the site has been radiocarbon dated. The site is in the middle Huai Valley.	imprints of rice grains	Stone spades are mentioned in the text, but not in the lithics section and are not drawn.	Kan and Zhou (2007)
Xiaosungan	Anhui	小孙岗	Shuangdun	charred grapes	Beta-388143	6200±30 BP	5170	5290-5050 cal. BC	Date is older than date for rice from H28 from Center for Applied Isoptope Studies	Has charred rice	Not recorded	Cheng et al. (2016)
Xiaosungan	Anhui	小孙岗	Shuangdun	charred grapes	Beta-388144	6110±30 BP	5075	5210-4940 cal. BC	As above	Has charred rice	As above	Cheng et al. (2016)
Xiaosungan	Anhui	小孙岗	Shuangdun	charred rice	CAIS-23324	6060±30 BP	4945	5050-4840 cal. BC	Direct date on charred rice.	Has charred rice	As above	Cheng et al. (2016)
Xiaosungan	Anhui	小孙岗	Shuangdun	charred rice	CAIS-23325	6100±30 BP	5070	5210-4930 cal. BC	As above	Has charred rice	As above	Cheng et al. (2016)
Xiaosungan	Anhui	小孙岗	Shuangdun	charred rice	CAIS-23326	5960±30 BP	4840	4940-4740 cal. BC	As above	Has charred rice	As above	Cheng et al. (2016)
MIDDLE YANGTZE												
Bashidang	Hunan	八十垱	Late Pengtoushan	Charcoal	BK-94112	7326±80 BP	6210	6390-6030 cal. BC	Dates are quoted by Chen (1999) at 5730 half life and corrected here. Given problems with old carbon/old wood when dating charcoal this date is regarded as suspect.	Has waterlogged rice remains, sometimes in high numbers.	Wood and bone cultivation tools are recorded from the site. But differ from those of the Lower Yangtze	Chen (1999, table 6). Cited from Pei (1996)
Bashidang	Hunan	八十垱	Late Pengtoushan	Charcoal	BK-94111	6792±70 BP	5700	5840-5560 cal. BC	As above dates are corrected to 5568 h.l. This and the date below suggest he site was occupied between 5900 to 5700 cal. BC.	As above	As above	Chen (1999, table 6). Cited from Pei (1996)
Bashidang	Hunan	八十垱	Late	Charcoal	BK-94110	6981±70 BP	5865	6000-5730 cal. BC	As above	As above	As above	Chen (1999, table 6). Cited from Pei (1996)

Pengtoushan	Hunan	彭頭山	Pengtoushan	carbonised rice temper	Ox-2210	7550±90 BP	6410	6590-6230 cal. BC	Thought to be acurrate. Other dates have been dismissed due to contamination issues within extracting carbon from the clay pottery matrix as they were by Hedges et al. (1992). The dates given by Crawford and Shen (1998) do not match Hedges (1992). It is suspected that the dates were converted at some time to the 5780 half-life, but then not converted back for later calibration	Large amounts of charred rice grains and chaff used as temper within the pottery. Selected for dating by hedges et al. (1992).	Not recorded	Hedges et al. (1992); Lu (1999: table 7.2); Crawford and Shen (1998)
Pengtoushan	Hunan	彭頭山	Pengtoushan	carbonised rice temper	Ox-2214	7040±140 BP	5945	6220-5670 cal. BC	As above. Thought possibly slightly too young. However it is more in line with dates on comparable cultures.	As above	Not recorded	Hedges et al. (1992); Lu (1999: table 7.2); Crawford and Shen (1998)
Pengtoushan	Hunan	彭頭山	Pengtoushan	carbonised rice straw temper?	BK-89016	7594±100 BP	6440	6640-6240 cal. BC	As above. Thought to be broadly accurate. Crawford and Shen (1998) have the dated material as charcoal. Lu (1999) as carbonized rice straw	As above	Not recorded	Chen and Hedges (1994); Lu (1999: table 7.2); Crawford and Shen (1998)
Chengbeixi	Hubei	城背溪	Chengbeixi	charcoal in pottery	ZK-2643	7988±250 BP	6980	7530-6430 cal. BC	Date is on charcoal from pottery and the descrepancy with BK-84028 raises questions of whether dates contain old carbon from the clay. Note date in Crawford and Shen (1998) uses 5730 h.l. Date is corrected here to 5568 h.l.	Rice tempered pottery as seen at Pengtoushan	Not recorded	Crawford and Shen (1998, table 2); Lu (1999, table 7.2)
Chengbeixi	Hubei	城背溪	Chengbeixi	charcoal in pottery	ZK-2644	8040±234 BP	7000	7530-6470 cal. BC	As above the date is corrected for 5568 h.l. But date is rejected as unreliable.	As above	Not recorded	Crawford and Shen (1998, table 2); Lu (1999, table 7.2)
Chengbeixi	Hubei	城背溪	Chengbeixi	Animal bone	BK-84028	6610±80 BP	5545	5710-5380 cal. BC	This date on animal bone is seem as more reliable than the dates on charcoal from pottery fabrics. Note the date in Crawford and Shen (1998) uses 5730 h.l. Date is corrected here to 5568 h.l.	As above	Not recorded	Crawford and Shen (1998, table 2); Lu (1999, table 7.2)
Zhicheng (north)	Hubei	枝城	Chengbeixi		no C14 date?		5550	est. 5700-5400 BC	No C14 date. Site thought to be broadly contemporary with Chengbeixi.	Rice temper in clay pottery as at Pengtoushan	?	Zhang Zhiheng (1998)
Liulinxi	Hubei	柳林溪	Chengbeixi		no C14 date?		5550	est. 5700-5400 BC	No C14 date. Site thought to be broadly contemporary with later Chengbeixi.	Rice imprints recorded and used as temper within pottery pastes.	Stone hoe is recorded in Chinese Arch. 2001 1(1)	Zhang Zhiheng (1998). Hubei Provincial Inst. Cultural Relics and Archaeology 2001
Zaoshi Level 9	Hunan	皂市	Lower Zaoshi Culture	Charcoal	BK-82081	6724±200 BP	5660	6020-5300 cal. BC	Date in Crawford and Shen (1998) uses 5730 h.l. Date is corrected here to 5568 h.l.	While rice temper seems likely it is unclear if rice is reported from this site	Not recorded	Crawford and Shen (1998, table 2); Lu (1999, table 7.2)
Zaoshi Level 9	Hunan	皂市	Lower Zaoshi Culture	Carbonized straw	QxA-2731	6583±90 BP	5515	5670-5360 cal. BC	Date is corrected here to 5568 h.l. Zaoshi Culture is often equated with Chengbeixi and Pengtoushan.	As above	Not recorded	Crawford and Shen (1998, table 2); Lu (1999, table 7.2)
Hujiawuchang	Hunan	胡家屋场	Lower Zaoshi Culture	carbonised rice temper	OxA-2731	6580±90 BP	5515	5670-5360 cal. BC	Thought by Hedges et al. (1992) along with dates below to be the better representation of the true date. Other dates have been omitted. Older of 4 dates.	charred grains and rice imprints in pottery temper	Not recorded	Hedges et al. (1992)
Hujiawuchang	Hunan	胡家屋场	Lower Zaoshi Culture	carbonised rice temper	OxA-2218	6210±90 BP	5155	5380-4930 cal. BC	As above. Youngest of 4 dates. Slightly younger but equated with Zaoshi Culture.	As above	Not recorded	Hedges et al. (1992)
Hujiawuchang	Hunan	胡家屋场	Lower Zaoshi Culture	carbonised rice temper	OxA-2222	6310±100 BP	5260	5480-5040 cal. BC	As above	As above	Not recorded	Hedges et al. (1992)
Hujiawuchang	Hunan	胡家屋场	Lower Zaoshi Culture	carbonised rice temper	OxA-2733	6350±170 BP	5270	5630-4910 cal. BC	As above	As above	Not recorded	Hedges et al. (1992)
NORTH OF THE MIDDLE YANGTZE (Upper Huai, Nanyang Basin, Hanshui)												
Jiahu I	Henan	贾湖	Jiahu Layer 1	ash	DY-K0185	7347±125 BP	6225	6450-6000 cal. BC	Dates converted from 5730 h.l. as given in HPIRA (1999; Table 92) to 5568 h.l.. The calibrated dates given in Zhang and Hung (2013) use 5730 h.l. and therefore when calibrated are incorrect. The dates especially on charcoal are highly variable and notably inconsistent within and across phases.	Has rice grains but no millet grains or evidence for millet agriculture, as often inferred (see Bellwood 1999). Rice domestication status unclear: no domestication traits.	Stone spades are recorded making it the only site with rice and definite stone cultivation tools	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 1	ash	BK-94172	7205±80 BP	6075	6240-5910 cal. BC	As above	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 1	human bone	BK-95013	6850±80 BP	5795	5970-5620 cal. BC	As above. Dates on human bone appear younger	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 2	charcoal	BK-94173	7958±75 BP	6855	7060-6650 cal. BC	As above. Charcoal dates appear too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 2	fruit stones	BK-91007	7734±60 BP	6555	6660-6450 cal. BC	As above. Date on this short-lived species appears significantly older than human bone dates from Jiahu I	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 2	human bone	BK-95014	7035±70 BP	5890	6030-5750 cal. BC	As above.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 3	charcoal	BK-94126	8050±100 BP	6995	7310-6680 cal. BC	As above. Charcoal dates appear too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu I	Henan	贾湖	Jiahu Layer 3	charcoal	BK-94178	7992±70 BP	6880	7080-6680 cal. BC	As above. Charcoal dates appear too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 4	charcoal	BK-94177	7861±110 BP	6770	7050-6490 cal. BC	As above. Dates on charcoal seem ntoably older than those on other material	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 4	ash	DY-K0189	6935±130 BP	5840	6060-5620 cal. BC	As above	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 4	ash	DY-K0186	6904±120 BP	5815	6020-5610 cal. BC	As above	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 5	human bone	BK-95018	7773±100 BP	6730	7030-6430 cal. BC	As above. This burial appears too old and is inconsistent with the phasing and other dates.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 5	charcoal	WB-83-60	7696±150 BP	6640	7030-6250 cal. BC	As above. Notably older than the ash deposits.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 5	human bone	BK-95017	6836±70 BP	5750	5880-5620 cal. BC	As above. Generally consistent in being slightly later than Phase I human burials.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu II	Henan	贾湖	Jiahu Layer 6	charcoal	BK-94176	7433±70 BP	6275	6450-6100 cal. BC	As above. Date appears slightly too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu III	Henan	贾湖	Jiahu Layer 7	charcoal	BK-94127	7239±80 BP	6130	6340-5920 cal. BC	As above. Date appears slightly too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu III	Henan	贾湖	Jiahu Layer 8	charcoal	BK-94174	7603±80 BP	6440	6630-6250 cal. BC	As above. Charcoal dates appear too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu III	Henan	贾湖	Jiahu Layer 8	charcoal	BK-94175	7297±90 BP	6195	6380-6010 cal. BC	As above. Date appears slightly too old.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Jiahu III	Henan	贾湖	Jiahu Layer 8	ash	DY-K0188	6818±130 BP	5750	5990-5510 cal. BC	As above. More consistent with other dates on ash and human burials.	As above	As above	HPIRA (1999; table 92); Zhang and Hung (2013)
Baligang	Henan	八里岗	pre-Yangshao	rice grain	BA-111568	7680±30 BP	6530	6600-6460 cal. BC	Direct AMS date on charred rice grains.	Has rice grains and spikelet bases. The grains appear to be wild while the spikelet bases are predominately of the non-shattering domesticated type.	No cultivation tools	Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	rice grain	BA-111569	7690±25 BP	6535	6600-6470 cal. BC	As above. Consistent with other dates on rice	As above	No cultivation tools	Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	rice grain	BA-111571	7710±25 BP	6535	6600-6470 cal. BC	As above. Consistent with other dates on rice	As above	No cultivation tools	Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	fruit husk	BA-08119	7445±55 BP	6325	6430-6220 cal. BC	Short lived species, date slightly younger than rice	As above	No cultivation tools	Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	charcoal	BAO-8129	7790±45 BP	6590	6700-6480 cal. BC	Slightly older but broadly consistent with rice	As above	No cultivation tools	Zhang and Hung (2013; table 2); Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	charcoal	BAO-8122	7370±60 BP	6235	6390-6080 cal. BC	Slightly younger than dates on rice	As above	No cultivation tools	Zhang and Hung (2013; table 2); Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	rice grain	BA-10080	7625±35 BP	6495	6570-6420 cal. BC	As above. Consistent with other dates on rice	As above	No cultivation tools	Zhang and Hung (2013; table 2); Deng et al. 2015
Baligang	Henan	八里岗	pre-Yangshao	rice grain	BA-10081	7670±45 BP	6520	6600-6440 cal. BC	As above. Consistent with other dates on rice	As above	No cultivation tools	Zhang and Hung (2013; table 2); Deng et al. 2015

Lijiacun	Shaanxi	李家村	Lijiacun	charcoal	ZK-1267	6069±90 BP	4985	5230-4740 cal. BC	Date quoted by Crawford and Shen (1998) is 7000-6000 BC; by Chen (1999) as pre-5000 BC; by Wu (1996) as 5500-5000 BC consistent with C14 dates (see Lu (1999).	Rice hulls present on construction debris. Bellwood (2006, 104) quotes site as having millet but this appears unsubstantiated.	Not recorded	Lu (1999, table 4.7); Crawford and Shen (1998); Chen (1999); Wu (1996); Bellwood (2006, 104).
Lijiacun	Shaanxi	李家村	Lijiacun	charcoal	ZK-1268	6180±90 BP	5090	5330-4850 cal. BC	As above	As above	Not recorded	Lu (1999, table 4.7); Crawford and Shen (1998); Chen (1999); Wu (1996)
Hejiawan	Shaanxi	何家湾	Laoguantai	no date?	no date?		5000	est. 5000-3000 BC	Date quoted by Wu (1996) is 5000-3000 BC. But by Chen (1999) as before 5000 BC. Dates likely to be similar to Lijiacun.	Rice hulls present on construction debris	Not recorded	Chen (1999); Wu (1996)

Site	Province	Local Script	Culture	C14 Material	Code	Date	Median	Calibrated 2 sigma	Comments	Crops	References
MIDDLE YELLOW RIVER											
Nanjiaokou	Henan	南交口	Early Yangshao	Setaria	BA08804-H02	5550±40	4395	4460-4330 cal. BC	Dates relate to earliest phase of occupation	Oryza, Setaria, Panicum	Qin 2009; Qin and Fuller 2009
Nanjiaokou	Henan	南交口	Early Yangshao	Setaria	BA08803-H01	5220±35	4095	4230-3960 cal. BC	As above		Qin 2009; Qin and Fuller 2009
Nanjiaokou	Henan	南交口	Early Yangshao	Panicum	BA08805-H02	5195±40	4085	4230-3940 cal. BC	As above	Oryza, Setaria, Panicum	Qin 2009; Qin and Fuller 2009
Nanjiaokou	Henan	南交口	Early Yangshao	rice	BA08802-H01	5125±35	3890	3990-3790 cal. BC	As above	Oryza, Setaria, Panicum	Qin 2009; Qin and Fuller 2009
Xipo	Henan	西坡	Miaodigou I - Middle Yangshao	Not C14 dated			3750	est. 4000-3500 BC	No C14 date reported.	Oryza, Setaria, Panicum	Ma 2005, 100-101; Weiskopf 2014
Yuanqiao	Henan	袁桥	Middle to Late Yangshao	No date recorded	N/A		3500	est. 4000-3000 BC	No C14 date reported.	Oryza, Setaria, Panicum	Fuller and Zhang 2007
Xiangjiawan	Shaanxi	向家湾	Late Yangshao	No Date Reported	N/A		4050	est. 5100-3000 BC		Oryza, Setaria, ?Panicum	Lui et al., 2008: site 26, 175; Shang et al., 2012
Xiangjiawan	Shaanxi	向家湾	Late Yangshao	No Date Reported	N/A		4050	est. 5100-3000 BC		Oryza, Setaria, ?Panicum	Lui et al., 2008: site 26, 175; Shang et al., 2012
Xiangjiawan	Shaanxi	向家湾	Late Yangshao	No Date Reported	N/A		4050	est. 5100-3000 BC		Oryza, Setaria, ?Panicum	Lui et al., 2008: site 26, 175; Shang et al., 2012
Xiangjiawan	Shaanxi	向家湾	Late Yangshao	No Date Reported	N/A		4050	est. 5100-3000 BC		Oryza, Setaria, ?Panicum	Lui et al., 2008: site 26, 175; Shang et al., 2012
Xinglefang	Shaanxi	兴乐坊	Miaodigou	Phytolith	Beta-409349	5110±30	3885	3980-3790 cal. BC		Oryza, Setaria, Panicum	Zuo et al. 2016, table 1; Liu et al., 2011
Xinglefang	Shaanxi	兴乐坊	Miaodigou	Charcoal	Beta-392838	4800±30	3585	3650-3520 cal. BC		Oryza, Setaria, Panicum	Zuo et al. 2016, table 1; Liu et al., 2011
Dingdian	Shanxi	丁店	Middle to Late Yangshao				3650	est. 4000-3300 BC	No C14 date reported.	Oryza, Setaria, Panicum	Song 2011
Yadi	Shanxi	崖底	Longshan	Not C14 dated			2200	2500-1900 cal. BC	Cultural layers dating to the Erlitou were also present but didn't contain rice	Oryza, Setaria	Jiang (2011)
Zigan	Shanxi	子干	Erlitou	Not C14 dated			1700	1900-1500 cal. BC		Oryza, Setaria	Jiang (2011)
Lixian	Gansu	礼县	Miaodigou	No Date Reported	N/A		3500	4000-3000 cal. BC	Rice reported in very low numbers at Lixian II & III. As below possibly intrusive.	Oryza, Setaria, Panicum	Ji 2009; Li et al. 2015
Houguanzhai	Gansu	后官寨	Late Yangshao, Middle Majiayao	Not recorded	Not reported	4230±60 BP	2815	3010-2620 cal. BC	Rice grains were in very low numbers in Yangshao layers and charred seeds of rice were recovered from overlying depoits dated to *c.* 500-1000 AD. The C14 dates appear Early Longshan.	As above	Zhou, X. et al. 2011
Houguanzhai	Gansu	后官寨	Late Yangshao, Middle Majiayao	Not recorded	Not reported	4170±50 BP	2750	2900-2600 cal. BC	As above.	As above	Zhou, X. et al. 2011
Houguanzhai	Gansu	后官寨	Late Yangshao, Middle Majiayao	Not recorded	Not reported	4160±60 BP	2735	2890-2580 cal. BC	As above.	Oryza, Setaria, Panicum	Zhou, X. et al. 2011
Houguanzhai	Gansu	后官寨	Late Yangshao, Middle Majiayao	Not recorded	Not reported	4150±60 BP	2730	2890-2570 cal. BC	As above	As above	Zhou, X. et al. 2011
SHANDONG											
Dongpan	South Shandong	东盘	Beixin	Rice grain	Beta-344113	5140±30 BP	3920	4040-3800 cal. BC	Only 2 rice grains were recovered. But also only one Panicum and one Setaria. Rice domestication status unknown.	Oryza, Setaria, Panicum	Jin et al. 2016; Wang et al. 2012
Beiqian	East Shandong	北阡	Dawenkou	Rice	Beta-344115	4340±30 BP	2960	3030-2890 cal. BC	Only 2 grains of rice, but many more Panicum and Setaria. Rice grain looks domesticated.	Oryza, Setaria, Panicum	Jin et al. 2016
Xujiacun	South Shandong	徐家村	Late Dawenkou/Early Longshan	Not C14 dated	No date		2800	3000-2600 cal. BC	1 Oryza, 2 Setaria, 3 panicum	Oryza, Setaria, Panicum	Chen 2007
Duanjiahe	South Shandong	段家河	Dawenkou/Longshan	Not C14 dated	No date		2500	3000-2000 cal. BC	Listed with Xilou below	Oryza, Setaria, Panicum. Triticum + Hordeum	Liu et al., 2008: site 47, 176, site 40, 166
Xilou	South Shandong	西楼	Dawenkou/Longshan	Not C14 dated	No date		2500	3000-2000 cal. BC		Oryza, Setaria	Lui et al., 2008: site 47, 176; JPIAC, 2013; Henan Arch Cass 1995
Dongpan	South Shandong	东盘	Late Longshan	Not C14 dated	No date		2300	2600-2000 cal. BC	Rice is well represented in these later layers	Oryza, Setaria, Panicum	d'Alpoim Guedes et al. 2015; Wang et al. 2011
Zhaojiazhuang	Shandong	赵家庄	Late Longshan	Not C14 dated	No date		2450	2600-2300 cal. BC	Large quantities of Oryza and Setaria	Oryza, Setaria, Panicum	Jin et al. 2011; Barton et al. 2014
Xuejiazhuang - Zhucheng	South Shandong	薛家庄村	Late Longshan	Not C14 dated	No date		2300	2600-2000 cal. BC	Only 4 grains of rice	Setaria, Panicum and Oryza	d'Alpoim Guedes et al. 2015; Jin et al. 2009
Chenjiazhuang	Shandong	程家庄	Late Longshan	Not C14 dated	No date		2250	2600-1900 cal. BC		Oryza, Setaria, Panicum	Song 2011
Tonglin	Central Shandong	桐林	Late Longshan	Not C14 dated	No date		2250	2600-1900 cal. BC	Large amounts of charred grain	Oryza, Setaria, Panicum	Song 2011
Yangjiaquan	East Shandong	杨家圈	Late Dawenkou	Not C14 dated?	No date		2175	2500-1850 cal. BC	No formal identification of millet species	Oryza and millets identified from pottery impressions.	Luan et al. 1997; 2007; Crawford et al. 2005; 2006. d'Alpoim Guedes et al. 2015
Liangchenzhen	South Shandong	两城镇	Longshan	Rice grain	TO-10206	3610±60 BP	1960	2150-1770 cal. BC	Rice and foxtail are well represented	Oryza, Setaria, Panicum	Crawford et al. 2005
ANHUI											
Yuchisi	Anhui	尉迟寺	Late Dawenkou	Not C14 dated	No date		2700	2800-2600 cal. BC		Oryza, Setaria	Zhao 2007; Wang and Jia, 1998; Liu et al., 2008: site 56, 165
MIDDLE YANGTZE/HAN BASIN											
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3047	5540±60	4380	4500-4260 cal. BC	Dates contemporary with earlier rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3041	5540±50	4405	4490-4320 cal. BC	Dates contemporary with earlier rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3052	5480±90	4275	4500-4050 cal. BC	Dates broadly contemporary with rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3048	5470±70	4265	4460-4070 cal. BC	Dates broadly contemporary with rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3054	5450±40	4295	4360-4230 cal. BC	Dates broadly contemporary with rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3046	5450±50	4305	4450-4160 cal. BC	Dates broadly contemporary with rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3049	5370±50	4195	4340-4050 cal. BC	Dates contemporary with later rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3050	5360±60	4190	4340-4040 cal. BC	Dates contemporary with later rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3042	5360±30	4190	4330-4050 cal. BC	Dates contemporary with later rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3043	5350±40	4190	4330-4050 cal. BC	Dates contemporary with later rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3045	5180±30	4000	4045-3955 cal. BC	Dates contemporary with latest rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	charred fragment	KIT-3051	4900±30	3750	3760-3740 cal. BC	Dates are later than rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	wood	KIT-3044	4890±70	3900	3930-3870 cal. BC	Dates contemporary with latest rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Tangjiagang (Pre-Daxi)	plant fragments	KIT-3053	4830±50	3610	3710-3510 cal. BC	Dates are later than rice dates	Oryza, Setaria	Nakamura 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2200	5620±60	4465	4590-4340 cal. BC	No Panicum present	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2195	5540±45	4395	4470-4320 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2201	5490±50	4350	4450-4250 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2199	5480±45	4345	4450-4240 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2196	5400±45	4205	4350-4060 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2202	5390±45	4195	4340-4050 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2194	5380±60	4195	4340-4050 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2193	5350±45	4185	4330-4040 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2277	5245±55	4100	4240-3960 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Chengtoushan	Henan	城头山	Early Daxi	rice grain	NUTA2-2278	5165±40	3925	4050-3800 cal. BC	As above	Oryza, Setaria	Nasu et al. 2007
Huitupo	Henan	灰土坡	Middle Yangshao	Not C14 dated			3750	est. 4000-3500 BC		Oryza, Setaria italica, Panicum miliaceum	Fuller and Qin n.d.; Peking University Baligang project

Baligang	Henan	八里岗	Early/Middle Yangshao	rice grain	BA111566	5350±25	4185	4320-4050 cal. BC		Oryza, Setaria, Panicum	Deng et al. 2015
Baligang	Henan	八里岗	Middle Yangshao	rice grain	BA081046	5085±35	3880	3970-3790 cal. BC		Oryza, Setaria, Panicum	Deng et al. 2015
Baligang	Henan	八里岗	Middle Yangshao	rice grain	BA081048	5035±35	3830	3950-3710 cal. BC		Oryza, Setaria, Panicum	Deng et al. 2015

SICHUAN CHINA (including initial spread of millets)

Yingpanshan	Sichuan	营盘山	Pre-Baodun - Majiayao	No date			2950	3200-2700 cal. BC	No rice is reported from this earlier site	Setaria, Panicum	Zhao and Chen J 2011; D'Alpoim Guedes and Butler 2014
Haxiu	Sichuan	哈休	Pre-Baodun	No date			3000	est. 4000-3500 BC	No rice is reported from this earlier site	Setaria, Panicum	D'Alpoim Guedes 2011; Zhao 2008
Guiyuanqiao	Sichuan	桂圆桥	Pre-Baodun	No date			2850	3000-2700 cal. BC	No rice is reported from this earlier site	Setaria, Panicum	D'Alpoim Guedes and Butler 2014; Aba et al. 2007
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110058	4060±30	2660	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110062	4015±35	2545	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110049	4010±50	2590	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110061	4005±30	2520	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110059	4000±30	2520	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110047	3890±35	2355	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110060	3885±30	2375	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA111215	3840±25	2330	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110048	3830±30	2305	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110052	3830±30	2305	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA111219	3735±20	2125	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110050	3730±30	2150	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110051	3705±30	2090	est. 4000-3500 BC		Oryza, Setaria	D'Alpoim Guedes and Butler 2014; D'Alpoim et al. 2013b

Site	Province	Local Script	Culture	C14 Material	Code	Date	Median	Calibrated 2 sigma	Comments	Crops	References
NORTHWEST SPREAD INTO CENTRAL ASIA											
Hurere	Qinghai	胡热热	Yangshao	Panicum	BA120182	4530±60	3260	3500-3020 cal. BC		Setaria and Panicum	Chen et al. (2015)
Gayixiangjing	Qinghai	呷依乡	Majiayao	Setaria	Beta-297655	4410±40	3120	3330-2910 cal. BC		Setaria and Panicum	Chen et al. (2015)
Gayixiangjing	Qinghai	呷依乡	Majiayao	Setaria	BA110899	4370±25	3000	3090-2910 cal. BC		Setaria and Panicum	Chen et al. (2015)
Lajia	Qinghai	喇家	Early-mid Majiayao	Charcoal	LUG10-58	4408±55	3120	3340-2900 cal. BC		Setaria	Dong et al. (2013); Liu et al. (2008) site 53, pp. 166
Hongtjiaozi	Qinghai		Majiayao	Setaria	BA110889	4395±30	3005	3100-2910 cal. BC		Setaria and Panicum	Chen et al. (2015)
Luowalinchang	Qinghai	洛哇林场	Majiayao	Setaria	Beta-24458	4110±30	2720	2870-2570 cal. BC		Setaria and Panicum	Chen et al. (2015)
Yuanyangchi	NW Gangsu	鸳鸯池	Manchang/?Banshan	No Date			2200	est 2400-2000 BC	Wheat is absent and not recorded from this site	Setaria	Liu et al. (2008)
Xihetan	NW Gangsu	西河滩	Majiayao (Machang type)	No Date			2150	est. 2300-2000 BC	Wheat is absent and not recorded from this site	Mainly Panicum some Setaria	Zhou et al. (2012); Zhou et al. (2016); Dodson et al. (2013)
Huoshiliang	North Gansu	火石梁	Siba Culture	Triticum grain	OZK603	3636±44	2015	est. 2135-1895 BC	Earliest secure date for wheat within China	Triticum, ?Hordeum, Panicum, Setaria	Dodson et al. 2013
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Millet seed	BA05804	3545±40	1885	2020-1750 cal. BC	N.B. Only dates on plant remains are presented here. Dates cited within Yang et al. (2014) are at the 5730 h.l. The dates given here follow Flad et al. (2010) and use the 5568 h.l.	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Wheat grain	BA05803	3375±40	1650	1770-1530 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Wheat grain	BA05794	3305±40	1595	1690-1500 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Millet seed	BA05795	3200±40	1505	1610-1400 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Millet seed	BA05796	3290±40	1560	1670-1450 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Wheat grain	BA05791	3225±30	1515	1610-1420 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xiaohe Cemetry	Xingjiang	小河墓地	Xintala	Millet seed	BA05793	3240±40	1525	1620-1430 cal. BC	As above	Triticum and Panicum	Flad et al. (2010); Li J-F et al. (2013); Yang et al. (2014)
Xintala	Xingjiang	新塔拉	Xintala	wheat grain	OZM451	3435±35	1760	1880-1640 cal. BC		Triticum, Hordeum and Panicum	Dodson et al. (2013); Zhao et al. (2013); Debaine-Francfort (1988)
Xintala	Xingjiang	新塔拉	Xintala	wheat grain	OZK663	3430±50	1755	1890-1620 cal. BC		Triticum, Hordeum and Panicum	Dodson et al. (2013); Zhao et al. (2013); Debaine-Francfort (1988)
Xintala	Xingjiang	新塔拉	Xintala	wheat grain	OZK662	3435±50	1760	1890-1630 cal. BC		Triticum, Hordeum and Panicum	Dodson et al. (2013); Zhao et al. (2013); Debaine-Francfort (1988)
Xintala	Xingjiang	新塔拉	Xintala	wheat grain	OZL437	3515±50	1835	1980-1690 cal. BC		Triticum, Hordeum and Panicum	Dodson et al. (2013); Zhao et al. (2013); Debaine-Francfort (1988)
Begash 1a	Kazakhstan	Бесагаш	Middle Bronze Age	millet and wheat	Beta-266458	3840±40	2310	2470-2150 cal. BC	Dates are earliest for Panicum within Central Asia	Triticum and Panicum	Frachetti et al. (2010); Spengler et al. (2014)
Begash 1a	Kazakhstan	Бесагаш	Middle Bronze Age	wood charcoal	Beta-266459	3760±40	2165	2300-2030 cal. BC	As above	Triticum and Panicum	Frachetti et al. (2010); Spengler et al. (2014)
Begash 1a	Kazakhstan	Бесагаш	Middle Bronze Age	wood charcoal	Beta-266460	3740±40	2155	2290-2020 cal. BC	As above	Triticum and Panicum	Frachetti et al. (2010); Spengler et al. (2014)
Begash 1a	Kazakhstan	Бесагаш	Middle Bronze Age	wood charcoal	Beta-266457	3720±40	2130	2280-1980 cal. BC	As above	Triticum and Panicum	Frachetti et al. (2010); Spengler et al. (2014)
Tasbas 2a	Kazakhstan	Тасбас	Late Bronze Age	wood charcoal	OS-93053	3150±35	1405	1510-1300 cal. BC	Dates are earliest for Setaria within Central Asia	Triticum, Hordeum, Panicum, Setaria	Spengler et al. (2014)
Tasbas 2a	Kazakhstan	Тасбас	Late Bronze Age	barley	OS-92277	3090±40	1335	1440-1230 cal. BC	As above	Triticum, Hordeum, Panicum, Setaria	Spengler et al. (2014)
Tasbas 2a	Kazakhstan	Тасбас	Late Bronze Age	barley	OS-91990	3030±35	1270	1410-1130 cal. BC	As above	Triticum, Hordeum, Panicum, Setaria	Spengler et al. (2014)
SOUTHWEST CHINA: SICHUAN, YUNNAN											
Haxiu	Sichuan	哈休	Pre-Baodun	No date			3000	est. 3300-3000 BC	As with Yingpanshan only millets with initial agriculturak spread	Setaria, Panicum	D'Alpoim Guedes 2011; Zhao 2008
Yingpanshan	Sichuan	营盘山	Pre-Baodun - Majiayao	no date recorded			3100	3500-2700 cal. BC	As above only millets with initial spread	Setaria, Panicum	Zhao ZJ and Chen J (2011)
Guiyuanqiao	Sichuan	桂圆桥	Pre-Baodun	No date			2850	3000-2700 cal. BC	No rice is reported from this earlier site	Setaria, Panicum	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110058	4060±30	2660	2840-2480 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110062	4015±35	2545	2630-2460 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110049	4010±50	2590	2840-2340 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110061	4005±30	2520	2580-2460 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110059	4000±30	2520	2580-2460 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110047	3890±35	2355	2480-2230 cal. BC	Earliest secure date for rice within Sichuan	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110060	3885±30	2375	2470-2280 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA111215	3840±25	2330	2460-2200 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110048	3830±30	2305	2460-2150 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110052	3830±30	2305	2460-2150 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA111219	3735±20	2125	2210-2040 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110050	3730±30	2150	2270-2030 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Baodun	Sichuan	宝墩	Baodun Phase 1	rice grain	BA110051	3705±30	2090	2200-1980 cal. BC	As above	Oryza, Setaria	d'Alpoim Guedes and Butler (2014); d'Alpoim et al. (2013b)
Changdu Karuo/Qamdo Karub	Tibet	昌都卡若 ཆབ་མདོ་མཁར་རོ་	Karuo	Foxtail Millet	BA111228	4115±25	2720	2870-2570 cal. BC	Dates on short-lived material were conducted by d'Alpoim Guedes et al. 2014.	Mainly Setaria/some Panicum	d'Alpoim et al. 2014; d'Alpoim Guedes and Butler (2014); CPAM and Sichuan University (1985)
Changdu Karuo/Qamdo Karub	Tibet	昌都卡若 ཆབ་མདོ་མཁར་རོ་	Karuo	Foxtail Millet	BA111229	3995±25	2520	2580-2460 cal. BC	Dates on short-lived material were conducted by d'Alpoim Guedes et al. 2014.	Mainly Setaria/some Panicum	d'Alpoim et al. 2014; d'Alpoim Guedes and Butler (2014); CPAM and Sichuan University (1985)
Changdu Karuo/Qamdo Karub	Tibet	昌都卡若 ཆབ་མདོ་མཁར་རོ་	Karuo	Broomcorn millet	Beta325960	3980±40	2480	2620-2340 cal. BC	Dates on short-lived material were conducted by d'Alpoim Guedes et al. 2014.	Mainly Setaria/some Panicum	d'Alpoim et al. 2014; d'Alpoim Guedes and Butler (2014); CPAM and Sichuan University (1985)
Changdu Karuo/Qamdo Karub	Tibet	昌都卡若 ཆབ་མདོ་མཁར་རོ་	Karuo	Foxtail Millet	BA111226	3910±25	2390	2480-2300 cal. BC	Dates on short-lived material were conducted by d'Alpoim Guedes et al. 2014.	Mainly Setaria/some Panicum	d'Alpoim et al. 2014; d'Alpoim Guedes and Butler (2014); CPAM and Sichuan University (1985)
Changdu Karuo/Qamdo Karub	Tibet	昌都卡若 ཆབ་མདོ་མཁར་རོ་	Karuo	Indet. Seed	BA111231	3895±25	2380	2470-2290 cal. BC	Dates on short-lived material were conducted by d'Alpoim Guedes et al. 2014.	Mainly Setaria/some Panicum	d'Alpoim et al. 2014; d'Alpoim Guedes and Butler (2014); CPAM and Sichuan University (1985)
Baiyangcun	Yunnan	白羊村	Baiyangcun Culture	charcoal	ZK-0220	3660±85	2075	2290-1860 cal. BC	Date in Yao (2010) is at the 5730 h.l., that within Rispolli (2007) gives both 5730 and 5568 h.l.	Oryza, Panicum and Setaria	Yong and Yunnan Prov. Museum (1981); Dal Martello et al. (in prep.); Rispoli (2007)
Baiyangcun	Yunnan	白羊村	Baiyangcun Culture	charcoal	ZK-0330	3570±85	1940	2190-1690 cal. BC	As above	Oryza, Panicum and Setaria	Yong and Yunnan Prov. Museum (1981); Dal Martello et al. (in prep.); Rispoli (2007)
Dadunzi	Yunnan	大墩子		charcoal	ZK-0229	3119±90	1370	1620-1120 cal. BC	Date in Yao (2010) and in Zhang and Hung (2010) are likely to be 5730 h.l. and the calibrated date from Rispoli (2007) implies this. Converted here to 5568 h.l.	Oryza, Panicum and Setaria	Jin H. et al. (2014)
Haimenkou	Yunnan	海门口	Neolithic (T1003-10-S1)	rice grain	BA-	3380±25	1685	1750-1620 cal. BC	Rice and Foxtail millet present in earliest levels	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-9-S2)	rice grain	BA-	3275±35	1545	1640-1450 cal. BC	As above	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-9-S2)	millet grains (*Setaria italica x3)*	BA-	3230±40	1520	1620-1420 cal. BC	As above	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-8-S2)	millet grains (*Setaria italica x3)*	BA-	3275±35	1545	1640-1450 cal. BC	As above	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-8-S2)	rice grain	BA-	3250±35	1530	1620-1440 cal. BC	As above	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-8-S2)	wheat grain	BA-	3105±25	1365	1440-1290 cal. BC	Early date on wheat for Yunnan	Oryza, Setaria, Triticum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Neolithic (T1003-8-S2)	Chenopodium seeds	BA-	3065±25	1335	1410-1260 cal. BC	Early date for Chenopodium	Oryza, Setaria, Chenopodium	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)

Haimenkou	Yunnan	海门口	Bronze Age (T1003-7-S2)	rice grain	BA-	3240±40	1525	1620-1430 cal. BC		Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-7-S3)	millet grain	BA-	3210±30	1505	1600-1410 cal. BC		Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1005-7-S1)	Chenopodium seeds	BA-	3170±25	1455	1500-1410 cal. BC	Early date for Chenopodium	Oryza, Setaria	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1005-7-S1)	wheat grain	BA-	3125±30	1395	1500-1290 cal. BC	Eariest date on wheat in Yunnan although this grain came from the level above 8 in which wheat is recorded above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1005-7-S2)	wheat grain	BA-	3095±30	1350	1430-1270 cal. BC	Early date on wheat	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1004-7-S6)	rice grain	BA-	3075±35	1330	1430-1230 cal. BC	Wheat, foxtail millet, broomcorn millet and rice common along with Cannabis all well established as crops in this phase	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-7-S2)	wheat grain	BA-	3060±35	1320	1420-1220 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-6-S2)	Chenopodium seeds	BA-	3080±25	1345	1420-1270 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1004-6-S3)	millet grains (*Setaria italica x3)*	BA-	3050±30	1315	1410-1220 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1004-6-S3)	bean (*Glycine*)	BA-	3045±40	1275	1420-1130 cal. BC	Early date for Soya bean. Crops as above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-6-S1)	wheat grain	BA-	3000±35	1255	1390-1120 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Xue (2010); Jin H (2014); D'Alpoim Guedes and Butler (2014); Xiao (1995)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-6-S2)	wheat grain	BA-	2975±45	1215	1390-1040 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1005-6-S4)	rice grain	BA-	2960±25	1160	1270-1050 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1004-5-S6)	millet grains (*Setaria italica x3)*	BA-	2435±30	580	760-400 cal. BC	Dates are from later phase	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-5-S2)	wheat grain	BA-	2445±35	580	760-400 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1005-4-S1)	rice grain	BA-	2400±20	470	540-400 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Haimenkou	Yunnan	海门口	Bronze Age (T1003-4-S2)	wheat grain	BA-	2405±35	570	750-390 cal. BC	As above	Oryza, Panicum, Setaria, Glycine, Triticum, Cannabis, Fagopyrum	Li and Min (2014); Yue Y (2010); Jin H (2014)
Shifodong	Yunnan	石佛洞		Date available but could not be obtained			1150	1450-850 cal. BC	Occurrence of rice and foxtail millet from earliest levels. Radiocarbon dating was conducted on the site and are available in the main site report but the authors have been	Setaria and Oryza	Zhao (2010); Jin H. et al. (2014); Liu and Dai (2008); Li, H. et al. 2016
Gantuoyan	Guangxi	感驮岩	Contemporary with Late Shang	rice grain	DY-1014	3365±50	1685	1860-1510 cal. BC	It is unclear if the dates quoted by Zhang and Hung (2010) are at the 5730 h.l. However, as the majority of the dates where this can be checked used the 5730 h.l. those shown here have also been corrected to the 5568 h.l. NB. this site is	Oryza, Panicum and Setaria	Zhang and Hung (2010); GZARAT and Napo Museum (2003)
Gantuoyan	Guangxi	感驮岩	Contemporary with Late Shang	millet grain	DY-D1015	3042±50	1275	1430-1120 cal. BC	As above	Oryza, Panicum and Setaria	Zhang and Hung (2010); ATGZ & Napo Museum 2003
Gantuoyan	Guangxi	感驮岩	Contemporary with Late Shang	rice grain	DY-1013	2801±50	970	1110-830 cal. BC	As above	Oryza, Panicum and Setaria	Zhang and Hung (2010); ATGZ & Napo Museum 2003
Mainland South China Coast (Spread of Rice without millets)											
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04294	4120±30	2720	2870-2570 cal. BC	These charcoal dates appear significantly older than the original dates below but are internally consistent and therefore seen as reliable.	Oryza sativa. Noted to be in low numbers and hunting/shellfish still seen as more important	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04295	4095±30	2685	2870-2500 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04299	4095±40	2680	2870-2490 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04292	4055±30	2660	2840-2480 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04293	4025±30	2550	2630-2470 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04290	3975±30	2465	2580-2350 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04298	3970±40	2460	2580-2340 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	charcoal	BA-04289	3965±30	2460	2580-2340 cal. BC	As above	Oryza sativa	Fujian Provincial Museum (2010); Ma et al. (2016); Jiao (2013)
Tanshishan	Fujian	昙石山	Tanishan Culture	animal bone	ZK-0099	3498±70	1830	2020-1640 cal. BC	Dates shown with corrected h.l. as assumed that as with other dates in Zhang and Hung (2010) the 5730 h.l. was originally given. Seems very late.	Oryza sativa	Zhang and Hung (2010); Yan (1989); Lin (2005)
Tanshishan	Fujian	昙石山	Tanishan Culture	shell	ZK-0098	3002±60	705	890-520 cal. BC	It is assumed that as with other dates in Zhang and Hung (2010) the 5730 h.l. was originally given. The calibrated dates are therefore corrected for the 5568 h.l. and using Marine13 curve (ΔR 91±29). The two dates are not statistically contemporary. THis being much younger.	Oryza sativa	Zhang and Hung (2010); Yan (1989); Lin (2005)
Zhuangbianshan	Fujian	庄边山	Tanishan Culture	Shell	Beta-347604	4350±30	2410	2490-2330 cal. BC	Large amounts of rice dehusking waste identified from phytoliths. Date calibrated using Marine 13 (ΔR 92±40). Co-ordinates - 26.100848, 119.145843	Oryza sativa (phytoliths in large numbers)	Ma et al. (2016)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal	BA-02152	3920±60	2390	2580-2200 cal. BC	Date is regarded as start of site. However it appears anomalous	Oryza sativa	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 9)	NZA-16011	3687±60	2090	2280-1900 cal. BC	Dates for earliest levels are consistent.	Oryza sativa	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 9)	BA-02155	3640±60	2015	2200-1830 cal. BC	As above	Oryza sativa	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 9)	NZA-16010	3634±55	2035	2200-1870 cal. BC	As above	Oryza sativa	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 9)	BA-02154	3620±100	1990	2290-1690 cal. BC	As above	Oryza sativa	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 4)	BA-02156	3440±60	1760	1910-1610 cal. BC	Later levels are consistent. Jiao (2007, 246) suggests that wheat and barley might be brought into historical cultural layers from lower levels but seems probable given the early date that they are intrusive.	Oryza sativa, probably intrusive Hordeum x1, also Triticum x7 in historical layer 2	Jiao 2007 (table 33, 246); Jiao (2013)
Huangguashan	Fujian	黄瓜山	Huangguashan Culture	Charcoal (Layer 4)	BA-02153	3430±80	1735	1940-1530 cal. BC	As above	As above	Jiao 2007 (table 33, 246); Jiao (2013)
Shaxia	Hong Hong	沙吓	Early Neolithic	No radiocarbon dates			2500	2500-2500 cal. BC	Date given as estimated within Zhang and Hung (2010).	Oryza sativa. Only a single grain is recorded so should be regarded with some caution.	Zhang and Hung (2010); Lu et al. (2006)
Shixia	Guangdong	石峡	Shixia phase (Phase 1)	charcoal	Bk76024	4100±110	2630	2920-2340 cal. BC	Dates shown with corrected h.l. as assumed that as with other dates in Zhang and Hung (2010) the 5730 h.l. was originally given. This date is older than those from Xinghuahe but broadly might be seen as representative of the earliest phase of Shixia Culture.	Oryza sativa	Yang (1978); Zhang et al. (2006); Zhang and Hung (2010)

Shixia	Guangdong	石峡	Shixia phase (Phase 3)	charcoal	Bk75046	4207±90	2760	3030-2490 cal. BC	Dates shown with corrected h.l. as assumed that as with other dates in Zhang and Hung (2010) the 5730 h.l. was originally given. This date for phase 3 is not statistically contemporary and older than that for the oldest phase 1. It is likely that it is subject to the problems with dating old wood and therefore suspect.	Oryza sativa	Yang (1978); Zhang et al. (2006); Zhang and Hung (2010)
Shixia	Guangdong	石峡	Shixia phase (Phase 3)	charcoal	Bk75050	3906±100	2440	2840-2040 cal. BC	Dates shown with corrected h.l. as assumed that as with other dates in Zhang and Hung (2010) the 5730 h.l. was originally given. This date is considered the most accurate for the Shixia culture as broadly contemporary with Xinghuahe	Oryza sativa	Yang (1978); Zhang et al. (2006); Zhang and Hung (2010)
Shixia	Guangdong	石峡		rice grain	Beta-397662	3810±30	2240	2340-2140 cal. BC	This the only direct date on rice from the site proivides a suitable illustration of discrepancies with old charcoal dates which range from 200-500 years earlier than those on rice. It might also be noted this same study indicates that rice from the older site of Guye also in Guangdong was intrusive.	Oryza sativa	Yang et al. (2016)
Xinghuahe	Guangdong	杏花河	Shixia phase	unknown	unknown	3916±120	2445	2860-2030 cal. BC	Material and lab numbers are unknown. The dates again are assumed to originally be presented using the 5730 h.l. The dates are broadly contemporary and consistent with the younger charcoal dates from Shixia. But still should be regarded with some caution.	Oryza sativa	Zhang and Hung (2010); Xiang and Yao (2006); Zhang et al. (2008)
Xinghuahe	Guangdong	杏花河	Shixia phase	unknown	unknown	3916±220	2390	3010-1770 cal. BC	As above	Oryza sativa	Zhang and Hung (2010); Xiang and Yao (2006); Zhang et al. (2008)
TAIWAN (MILLETS AND RICE)											
Nanguanlidong	Taiwan	南关里东	Ta-p'en-keng	charcoal	NTU-3974	4110±50	2685	2880-2490 cal. BC	It is unclear if the dates from NTU given in Hung and Carson (2014) citing Tsang et al. (2006) represent the 5568 or 5730 h.l. GX dates from Geochron Laboratories, USA would originally be given at the 5568 h.l. and have been treated as such. However they may have been converted to 5730 h.l.	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Zhang and Hung (2010)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	charcoal	NTU-3489	4080±50	2675	2870-2480 cal. BC	As above	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	charcoal	GX-27788	4040±40	2650	2840-2460 cal. BC	As above	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	charcoal	NTU-3452	3950±40	2440	2580-2300 cal. BC	As above. Slightly younger and raises questions as to the possibility of the old wood affect on the above dates. This date is thought broadly reliable.	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	charcoal	GX-27329	3890±110	2435	2840-2030 cal. BC	As above	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	charcoal	GX-27787	3730±90	2185	2460-1910 cal. BC	As above. Notably somewhat younger but the larger error might bring it in-line to the two dates above.	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	marine shell	GX-27327	4470±60	2625	2840-2410 cal. BC	Date corrected for the marine resevoir effect using Marine13 curve (ΔR 87±38) and is broadly in line with the older charcoal dates.	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	marine shell	NTU-3493	4450±40	2580	2760-2400 cal. BC	As above	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	marine shell	NTU-3496	4230±40	2275	2450-2100 cal. BC	As above. Broadly in line with younger dates	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
Nanguanli	Taiwan	南关里	Ta-p'en-keng	marine shell	GX-27328	4190±50	2210	2410-2010 cal. BC	As above	Oryza sativa, Panicum and Setaria	Tsang et al. (2006:316-8); Hung and Carson (2014); Zhang and Hung (2010); Tsang et al. (2017)
K'en-ting	Taiwan	墾丁	Ta-p'en-keng	None			2500	2500-2500 cal. BC	No radiocarbon dates but generally cited as 4500 BP/2500 BC.	Oryza sativa - impressions in pottery	Bellwood (2007: 213); Li K-C (1983; 1987)
MAINLAND SE ASIA (SITES WITH MILLETS)											
Nil Kham Haeng	Thailand	นิลแขมแหง	Neolithic/Bronze Age	unknown	B-24459	?	1100.5	1301-900 cal. BC	The date for sample B-24459 is 1301-900 BC but given as 1100-700 BC in Piggott et al. (2006)	Oryza and Setaria	Pigott et al. (2006); Natapintu (1991)
Non Mak La	Thailand	โนนหมากลา	Neolithic	No Dates			1950	2100-1800 cal. BC	No radiocarbon dates are available for this site.	Setaria	Higham (1989, 269-274); Pigott et al. (2006); Weber et al. (2010)
Non Mak La	Thailand	โนนหมากลา	Neolithic/Bronze Age	No Dates			1300	1500-1100 cal. BC	As above	Setaria	Higham (1989, 269-274); Pigott et al. (2006); Weber et al. (2010)
Non Pa Wai	Thailand	โนนป่าหวาย	Neolithic	Foxtail Millet	No Lab Code	3870±40	2335	2470-2200 cal. BC	No laboratory codes. Date is earliest date for southwest spread of Setaria.	Setaria	Weber et al. (2010)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5487	4390±110	3035	3370-2700 cal. BC	dates is much older than other dates from the same layer. Suspect hearth deposits may be mixture of charcoal and clay that might contain "old" carbon. Has been dismissed.	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	NZ-7063	4310±310	2880	3710-2050 cal. BC	Probably still slightly too old by comparision with other dates	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5490	3730±100	2180	2460-1900 cal. BC	As above	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	NZ-7060	3680±90	2060	2350-1770 cal. BC	As above	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5486	3610±90	1980	2270-1690 cal. BC	Regarded as upper limit of probable date range	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5488	3580±100	1935	2210-1660 cal. BC		rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5493	3560±120	1945	2280-1610 cal. BC		rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5491	3530±80	1895	2130-1660 cal. BC		rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5492	3480±110	1830	2140-1520 cal. BC		rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5489	3420±90	1725	1950-1500 cal. BC		rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5485	3410±110	1735	2020-1450 cal. BC	Regarded as lower limit of probable date range	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Khok Phanom Di (Layer 10)	Thailand	โคกพนมดี	Neolithic	charcoal	ANU-5484	3280±140	1575	1930-1220 cal. BC	Possibly too young.	rice from layer 10 (Thompsen 1996)	Thompson (1996); Maloney and McAlister (1990)
Tongle Sap Lake (6 sites)	Cambodia	ទន្លេសាប	Neolithic	charcoal	R26608/3	?3681±?60	2046	2205-1887 cal. BC	The laboratory number given in Vanna (2002) is the submission number and not an NZA number as would normally be given. It is believed the uncalibrated date is likely to be 3681±60 BP which calibrates using the old InTCal 98 curve (as Vanna is likely to have used) at 2205-1887 cal. BC at 94.2% probability.	Only Oryza on 6 sites	Vanna (2001; 2002)
Krek 52/62	Cambodia	ក្រែក 52/62	Neolithic	pottery organic temper	ETH-18972	3990±70	2570	2860-2280 cal. BC	Problems with discrepancy in the dates and with dating organics in a clay matrix are noted by Albrecht et al. (2006). Probably too early.	Oryza	Vincent (2003); Albrecht et al. (2001: 42)
Krek 52/62	Cambodia	ក្រែក 52/62	Neolithic	pottery organic temper	ETH-18972	3495±75	1830	2030-1630 cal. BC	As above. This date is also seen as unreliable.	Oryza	Vincent (2003); Albrecht et al. (2001: 42)

Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31909	3310±30	1580	1660-1500 cal. BC	Seen as mainly hunter-gatherer-fisher subsistence with low frequencies of domesticates.	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31907	3260±35	1530	1620-1440 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31906	3250±30	1535	1620-1450 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31912	3250±30	1535	1620-1450 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31913	3245±30	1525	1610-1440 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31911	3230±35	1515	1610-1420 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30823	3200±35	1500	1600-1400 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30833	3195±40	1595	1610-1580 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30830	3190±45	1460	1610-1310 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-31910	3190±30	1465	1520-1410 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30832	3190±35	1465	1530-1400 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30836	3165±30	1450	1510-1390 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30825	3150±35	1405	1510-1300 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30829	3150±40	1405	1510-1300 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30835	3130±30	1395	1500-1290 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30831	3130±35	1395	1500-1290 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30827	3125±35	1390	1500-1280 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30824	3085±35	1340	1430-1250 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal	SANU-30826	3080±35	1340	1430-1250 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015); Castillo et al., in press
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/3	3635±85	2015	2280-1750 cal. BC	2003 excavations; no archaeobotanical data. As often with bulk charcoal dates contamination by older and younger material can be a problem.	Oryza and Setaria	Oxenham et al. (2015): table S2
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/3	3545±85	1900	2140-1660 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015): table S2
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/2	3330±100	1655	1890-1420 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015): table S2
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/2	3200±100	1480	1740-1220 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015): table S2
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/1	2560±130	685	980-390 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015): table S2
Rach Nui	Vietnam	Rạch Núi	Neolithic	charcoal (bulk)	HNK-177/1	2430±50	580	760-400 cal. BC	As above	Oryza and Setaria	Oxenham et al. (2015): table S2
RUSSIA - FAR EAST											
Krounovka-1	Russian Far East	Кроуновка	Krounovsky	unknown	NUTA-5643	4671±31	3495	3630-3360 cal. BC	As above	Panicum miliaceum, Perilla and ?1x Setaria, gathered plants were well represented	Sergusheva and Vostretsov, 2009
Krounovka-1	Russian Far East	Кроуновка	Neolithic	unknown	Beta-171662	4640±40	3485	3620-3350 cal. BC	As above	As above	Sergusheva and Vostretsov, 2009
Zaisanovka-1	Russian Far East	Зайсановка-1	Zaisanovsky	unknown	NUTA-5282	4010±44	2620	2840-2400 cal. BC	As above	Setaria. Grains very small	Sergusheva and Vostretsov, 2009
Zaisanovka-1	Russian Far East	Зайсановка-1	Zaisanovsky	unknown	NUTA-5483	3972±31	2460	2580-2340 cal. BC	As above	As above	Sergusheva and Vostretsov, 2009
Zaisanovka-7	Russian Far East	Зайсановка-7	Zaisanovsky	No dates given			2600	2800-2400 cal. BC		Possible impressions of Panicum in ceramics. Gathered foods are well represented but no remains of cultigens. However, agricultural tools are present.	Sergusheva and Vostretsov, 2009
Novoselische-4	Russian Far East	Новоселище	Zaisanovsky	unknown	AA-13400	3840±70	2260	2480-2040 cal. BC	As above	Panicum	Sergusheva and Vostretsov, 2009
Novoselische-4	Russian Far East	Новоселище	Zaisanovsky	unknown	AA-36748	3755±35	2160	2290-2030 cal. BC	As above	Panicum	Sergusheva and Vostretsov, 2009
KOREA											
Neunggok	South Korea	능곡	Middle Chulmun	Foxtail Millet	Beta-252973	4740±40	3505	3640-3370 cal. BC	Direct date on millet. Earliest secure date.	Panicum & Setaria*1	Lee G. A. (2011, table 1)
Daechon-ri	South Korea	대천리	Middle Chulmun	Charred wood	SNU-267	4590±70	3360	3630-3090 cal. BC	Uncharred rice, along with barley and wheat, were recovered from this site and therefore it's antiquity is questionable and potentially more recent (see Crawford and Lee 2003; Ahn 2010)	Panicum, Setaria, uncharred Oryza likely to be contaminant	Han et al. (2003); Lee (2009; 2011); Ahn (2010)
Daechon-ri	South Korea	대천리	Middle Chulmun	Charred wood	SNU-268	4490±40	3190	3360-3020 cal. BC	As above	Panicum, Setaria, ?Oryza (as above)	Han et al. (2003); Lee (2009; 2011); Ahn (2010)
Daechon-ri	South Korea	대천리	Middle Chulmun	Charred wood	SNU-263	4400±60	3120	3340-2900 cal. BC	As above	Panicum, Setaria, ?Oryza (as above)	Han et al. (2003); Lee (2009; 2011); Ahn (2010)
Daechon-ri	South Korea	대천리	Middle Chulmun	Charred wood	SNU-269	4240±110	2905	3320-2490 cal. BC	As above	Panicum, Setaria, ?Oryza (as above)	Han et al. (2003); Lee (2009; 2011); Ahn (2010)
Tongsamdong [Dongsam-Dong]	South Korea	통삼동	Middle Chulmun	Foxtail millet	TO-8783	4590±100	3330	3640-3020 cal. BC	Direct date on millet from house floor within 2000 excavations	Panicum, Setaria*1	Crawford and Lee (2003); Lee (2011, table 1)
Pyeonggeodong	South Korea	평거동	Middle Chulmun	Broomcorn millet	SNU-252972	4340±40	2990	3090-2890 cal. BC	Direct date on Broomcorn millet	Panicum*1 & Setaria	Lee (2011, table 1)
Gahyeon-ri	South Korea	가현리	Middle Chulmun	Peat	KSU-no number	3890±30	2380	2470-2290 cal. BC	This date is reported in Ahn (2010) as 4010±25, in Choe and Bale (2002) as 4020±25 and in Lee (2011) as 3890 ±30 BP. Lee (2011) references Kang et al. (1993) who recalibrated Korean dates. This has not been seen but it is suspected the date was corrected by Kang et al. from a 5570 half-life	Oryza & Setaria. Waterlogged and recovered and dated from peat. Therefore as with other sites in this region from which rice has been recovered from peat this may be natural wild rice (see Ahn 2010).	Im (1990); Ahn (2010); Lee (2011); Kang et al. 2011; Choe and Bale (2002)
Gawaji/Kawaji [Islan 2)	South Korea	가와지	Middle Chulmun	Peat	Beta-45536	4330±80	3015	3340-2690 cal. BC	Ahn (2010) cites these two further cases of earlier C14 dates rice husks in peat near Gahyeon-ri. However as Ahn states in neither case were these rice husks associated with archaeological material and therefore are likely of wild rice. As such the evidence from all these sites cannot be used to support the cultivation of rice at this date.	Oryza. May be wild see comment	Ahn (2010)
Seongjeo-ri [Islan 1)	South Korea	성저리	Middle Chulmun	Peat	Beta-48484	4070±80	2675	2890-2460 cal. BC	Ahn (2010) cites these two further cases of earlier C14 dates rice husks in peat near Gahyeon-ri. However as Ahn states in neither case were these rice husks associated with archaeological material and therefore are likely of wild rice. As such the evidence from all these sites cannot be used to support the cultivation of rice at this date.	Oryza. May be wild see comment	Ahn (2010)
Masan-ri	North Korea	마산리	Middle Chulmun	No C14 dates			2750	est. 3500-2000 BC	As with Jitap-Ri it is unclear exactly how well identified this material is.	Setaria italica	Aikens and Lee (2014)
Jitap-ri	North Korea	지탑리	Middle Chulmun	No C14 dates			2750	est. 3500-2000 BC	Some serious problems as to autheticity and identifications of plant finds from this site (see Lee 2011; Kim 2014)	Possible Setaria italica. Maybe barnyard millet?	Yoon Seo Suk (2001); Do and Hwang (1961); Kim (2014); Choe and Bale (2002)
Oun 1	South Korea	오운 1	Middle Chulmun	foxtail millet	TO-8607	4030±100	2585	2880-2290 cal. BC	Direct date on Setaria italica	Setaria italica	Ahn (2010); Lee (2011)
Oun 1	South Korea	오운 1	Early Mumun	rice	TO-8605	3610±280	2090	2870-1310 cal. BC	Date on rice has a wide range that just falls outside further dates on rice and foxtail millet from same house [104] Date SNU-125 (see Lee 2011). Following Ahn (2010) the date should be dismissed as unreliable and rice farming in the Chulmun period is not yet confirmed	Setaria italica; rice at this date is regared as uncofirmed and the radiocarbon date as unreliable.	Ahn (2010); Lee (2011)
Oun 1	South Korea	오운 1	Early Mumun	rice	SNU-125	2850±60	1030	1210-850 cal. BC	Earliest confirmed co-occurrence of rice and foxtail millet	Setaria italica, Oryza	Ahn (2010); Lee (2011)

Oun 1	South Korea	오운 1	Early Mumun	foxtail millet	SNU-126	2830±60	1015	1200-830 cal. BC	As above	Setaria italica, Oryza	Ahn (2010); Lee (2011)
Oun 1	South Korea	오운 1	Early Mumun	foxtail millet	TO-8637	2800±100	1010	1230-790 cal. BC	As above	Setaria italica, Oryza	Ahn (2010); Lee (2011)
Gyodong: House No. 1	South Korea	교동	Early Mumun	rice	SNU 08-305	3040±60	1275	1440-1110 cal. BC	Presently earliest direct date for cultivated rice in Korea. However, as with Oun above the date again is not consistent with the date on rice below from the same house.	Setaria italica, Oryza	Ahn (2010)
Gyodong: House No. 1	South Korea	교동	Early Mumun	rice	PED-11437	2860±20	1030	1120-940 cal. BC	As above. It should be noted that the dates from this house are not consistent	Setaria italica, Oryza	Ahn (2010); Shoda (2010)
Sosa-dong: House No. Ga-10	South Korea	소사동	Early Mumun	rice	SNU 05-1014	2840±50	1025	1200-850 cal. BC		Oryza and Hordeum reported	Ahn (2010); Korean Institute of Heritage 2008; Kim et al. 2013
Sanjik-ri: House No. 12	South Korea	산직리	Early Mumun	rice	SNU 05-440	2790±60	960	1110-810 cal. BC		Oryza	Ahn (2010)
Songdam-ri: House KC-001	South Korea	송담리	Early Mumun	rice	PED-11435	2720±20	860	910-810 cal. BC		Oryza	Shoda (2010)
JAPAN											
Nabatake	Japan	菜畑	Final Jomon/Yamanotera		Level 13	3000±80	1220	1430-1010 cal. BC	The site has good evidence for tools associated with cultivation, along with fields. It is generally seen as spaning the Yamoantera phase both attributed to the Final Jomon and the Initial Yayoi. As such the site could date anywhere between 800 BC to 400 BC, but more likely 500-400 BC (Kumar 2009). The C14 dates are therefore too early and are are inconsitent with the stratigraphy. Unforunately it is unclear what material was dated e.g. peat, bulk charcoal etc. The dates are all seen as unreliable.	No charred cultigens were recovered from the lowest levels	Crawford 1992 (citing Tosu-shi Kyoiku Iinkai 1982); Kasahara (1982); Imamura (1996: 136); Takahashi (2009); Kumar (2009, 28)
Nabatake	Japan	菜畑	Final Jomon/Yamanotera		Level 10-11	4030±65	2605	2870-2340 cal. BC	As above. This much older date from a stratigraphically later level illustrates the problems with the dating on this site.	No charred cultigens were recovered from the lowest levels	Crawford 1992 (citing Tosu-shi Kyoiku Iinkai 1982); Kasahara (1982); Imamura (1996: 136); Takahashi (2009); Kumar (2009, 28)
Nabatake	Japan	菜畑	Final Jomon/Yamanotera		Level 10-11	2680±80	800	1050-550 cal. BC	While this and the date below do appear younger it is unknown if they are on different material to the other dates, or may suffer from similar problems	Perillia seeds and a single Setaria and Oryza at Level 11, mung bean?	Crawford 1992 (citing Tosu-shi Kyoiku Iinkai 1982); Kasahara (1982); Imamura (1996: 136); Takahashi (2009); Kumar (2009, 28)
Nabatake	Japan	菜畑	Final Jomon/pre-Yamanotera		Level 8	2620±60	730	920-540 cal. BC	As above	One rice grain, mung bean, Perilla	Crawford 1992 (citing Tosu-shi KyoikuIinkai 1982); Kasahara (1982)
Nabatake	Japan	菜畑	Final Jomon/pre-Yamanotera		Level 8	3230±100	1505	1750-1260 cal. BC	This date is older than dates stratigraphically below.	As above	Crawford 1992 (citing Tosu-shi KyoikuIinkai 1982); Kasahara (1982)
Nabatake	Japan	菜畑	Final Jomon/pre-Yamanotera		Level 8	2960±90	1175	1420-930 cal. BC	Date was dismissed as too old	As above	Crawford 1992 (citing Tosu-shi KyoikuIinkai 1982); Kasahara (1982)
Kuwagaishimo	Japan	桑飼下	Late Jomon	No C14 dates			1250	1500-1000 cal. BC	Two barley and Azuki beans , along with were also recorded from this site. The date of the site is estimated as Late Jomon. But given the presence of barley it is likely the material could be intrusive. The record should be dismissed.	Oryza carbonized grains; 2x Hordeum	Hudson (1999, table 5.2); Kotani (1981); Nishida (1975); Crawford (1992)
Itaya III	Japan	板谷Ⅲ	Late Jomon / Late Tottaimon	Unknown if C14 dated. Uncalibrated date is our estimate from the calibrated date given in Nasu and Momohara (2016).	unknown	2850±50	1045	1200-890 cal. BC	It is unclear if there is a C14 date for this site. The reported date is not thought reliable. The ceramic phasing (Tottimon 突帯文) as with other records here is generally equated as Late Final Joman/Early Yayoi and so at earliest between 800-400 BC.	Oryza. Impressions within pottery	Nasu and Momohara (2016)
Kazahari	Japan	カザハリ	Final Jormon/ Tokoshinai IV	rice grains	TO-4086	2810±270	1035	1690-380 cal. BC	The date ranges are very wide and the estimates could still place the date within the traditional framework. The likely date probably lies between 980-380 BC and would as such be the earliest site with rice, foxtrail and broomcorn millet. Although only one grain of Panicum was recovered.	Oryza, Setaria and single find of Panicum	D'Andrea (1995); D'Andrea et al. (1995)
Kazahari	Japan	カザハリ	Final Jormon/ Tokoshinai IV	rice grains	TO-2202	2540±240	665	1280-50 cal. BC	As above	Panicum & Oryza	D'Andrea (1995); D'Andrea et al. (1995)
Ryugasaki 滋賀	Japan	竜ケ崎A	Final Jomon/pre-Yamanotera/Nagahara	Panicum	PLD-5304	2550±25	680	810-550 cal. BC	This is probably the earliest and most reliable dating for the introduction of agriculture to Japan. However neither foxtail milllet nor rice has not been recovered from the site.	Panicum	Miyata (2007); Obata (2011, 168); Miyata et al. (2007)
Uenoharu	Japan	上野原	Final Jomon/pre-Yamanotera	No C14 dates			650	1000-300 cal. BC		Oryza carbonized grains, pottery impressions	From Hudson (1999, table 5.2) citing Kotani 1972
Eryoharu	Japan	飼領原	Final Jomon/pre-Yamanotera	No C14 dates			650	1000-300 cal. BC		Oryza carbonized grains	From Hudson (1999, table 5.2) citing Kagawa 1971
Oishi	Japan	大石	Final Jomon/pre-Yamanotera	No C14 dates			650	1000-300 cal. BC	Has hoes and agricultural tools recorded. But date is uncertain.	Oryza carbonized grains, pottery impressions	From Hudson (1999, table 5.2) citing Kagawa 1972; Kagawa 1973
Kureishibaru	Japan	礫石原	Final Jomon/pre-Yamanotera	No C14 dates			650	1000-300 cal. BC		Oryza carbonized grains, pottery impressions	From Hudson (1999, table 5.2) citing Furuta 1972
Yonetake	Japan	米竹 大分	Yayoi Period	rice	PLD-5104	2235±20	295	390-200 cal. BC	Reliable dating but would be thought of at the end of the transition to rice/millet agriculture in Japan.	Panicum & Oryza	Nishimoto (2007); Obata (2011,186-187)
Yonetake	Japan	米竹 大分	Yayoi Period	Panicum	PLD-5106	2230±20	290	380-200 cal. BC	as above	Panicum & Oryza	Nishimoto (2007); Obata (2011,186-187)
Ukikunden	Japan	宇木汲田	Yu'usu - Final Jomon - Initial Yayoi	charcoal	Kuri-0054	2240±50	275	400-150 cal. BC	Site has Yu'usu style pottery. The date seems slightly later but is thought reliable.	Oryza. Rice husks reported from shell layers	Kagawa (1973); Hudson (1999, table 5.5)
Ukikunden	Japan	宇木汲田	Yu'usu - Final Jomon - Initial Yayoi	shell	Kuri-0053	2370±50	155	370 cal. BC - 60 AD	Date corrected for the marine resevoir effect using Marine13 curve (ΔR -94±72). The correction brings this date within the range of the charcoal date.	Oryza. Rice husks reported from shell layers	Kagawa (1973); Hudson (1999, table 5.5)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-5109	2185±25	265	360-170 cal. BC	As with Yonetake these are the earliest reliable dates for foxtail millet and rice together, but are likely to lie towards the end of the transition.	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	Setaria italica	PLD-6466	2185±35	265	370-160 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-6463	2175±30	245	370-120 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-5111	2165±20	240	360-120 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	?	PLD-5110	2160±20	235	360-110 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-6461	2140±35	205	360-50 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-6459	2125±35	200	360-40 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-9492	2125±35	200	360-40 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-6458	2080±35	100.5	200-1 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)
Shimogouri	Japan	下郡 大分	Yayoi Period	rice	PLD-6460	2080±35	100.5	200-1 cal. BC	As above	Setaria & Oryza	Nishimoto (2007); Obata (2011,186-187)

Aba ZQZW, Sichuan SWKY, Chengdu SWKY, Maerkang XWXB, Aba ZW [阿坝藏族羌族自治洲文物管理所, 四川省文物考古研究院, 成都文物考古研究所, 马尔康县文化体育局]. 2007. *A brief report on the investigation of the site of Haxiu, Ma'erkang County, Sichuan Province [四川马尔康县哈休遗址调查简报]*. Sichuan Wenwu [四川文物]. 2007(4): 8-16. [in Chinese].

Ahn, Sung-Mo. 2010. The emergence of rice agriculture in Korea: archaeobotanical perspectives. *Archaeological and Anthropological Sciences* 2: 89–98.

Aikens, C. Melvin and Gyoung-Ah Lee. 2014. Postglacial inception and growth of anthropogenic landscapes in China, Korea, Japan, and the Russian Far East. *Anthropocene* 4: 46-56.

Albrecht, Gerd, Miriam Noel Haidle, Chhor Sivleng, Heang Leang Hong, Heng Sophady, Heng Than, Mao Someaphyvath, Sirik Kada, Som Sophal, Thuy Chanthourn and Vin Laychour. 2001. Circular earthwork Krek 52/62: recent research on the prehistory of Cambodia. *Asian Perspectives* 39 (1-2): 20-46

Barton, Loukas. 2009. *Early Food Production in China's Western Loess Plateau*. PhD Dissertation, University of California, Davis.

Barton, Loukas, Seth D. Newsome, Fa-Hu Chen, Hui Wang, Thomas P. Guilderson and Robert L. Bettinger 2009. Agricultural origins and the isotopic identity of domestication in northern China. *Proceedings of the National Academy of Sciences U.S.A.* 106(14): 5523-5528.

Bellwood, Peter. 2006. Asian farming diasporas? Agriculture, languages and genes in China and Southeast Asia. In Miriam T. Stark (ed.) *Archaeology of Asia.* Oxford. Blackwell.

Bellwood, Peter. 2007. *Prehistory of the Indo-Malaysian Archipelago*. Canberra: ANU Press.

Bestel, Sheahan, Gary W Crawford, Li Liu, Jinming Shi, Yanhua Song and Xingcan Chen. 2014. The Evolution of Millet Domestication, Middle Yellow River Region, North China: Evidence from Charred Seeds at the Late Palaeolithic Shizitan S9 Site. *The Holocene* 24(3): 261-265.

Bettinger, Robert L., Loukas Barton and Robert G. Elston. 2005. *Report on 2002 archaeological fieldwork in Gansu and Ningxia provinces*, PRC. http://www.anthro.ucdavis.edu/card/usprc/publications.htm.

Chen, Fa-hu, Guanghui Dong, Dongju Zhang, Xinyi Liu, Xia Jia, Chengbang An and Martin K. Jones. 2015. Agriculture facilitated permanent human occupation of the Tibetan Plateau after 3600 BP. *Science* 347(6219): 248-250.

Chen, Wenhua. 1994. *Zhongguo Nongye Kaogu Tulu (Atlas of Agricultural Archaeology in China)*. Nancheng: Jiangxi Press of Science and Technology. [In Chinese].

Chen, Xingcan. 1999. On the earliest evidence for rice cultivation in China. Bulletin of the *Indo-Pacific Prehistory Association* 18(2): 81-93.

Chen, Xuexiang [陈雪香]. 2007. Analysis of flotation samples from Neolithic sites in the Rizhao area of Shandong Province [山东日照两处新石器时代遗址浮选土样结果分析]. *Nanfang Wenwu [南方文物]* 1: 92-94. [in Chinese].

Cheng, Zhijie, Yuzhang Yang , Juzhong Zhang , Fang Fang, Jie Yu, Bingbai Chen, Changfu Chen, Hui Zhang and Xicheng Gong. 2016. The study of charred plant remains from the site of Xiaoganggang, Huainan City, Anhui. [淮安徽南小孙岗遗址炭化植物遗存研究]. *Quaternary Sciences [第四纪研究]* 36(2): 302-311. [in Chinese].

Choe, Chong-Pil and Martin T. Bale. 2002. Current perspectives on settlement, subsistence, and cultivation in prehistoric Korea. *Artic Anthropology* 39(1-2): 95-121.

CPAM (Commission for the Preservation of Ancient Monuments, Tibet) and Sichuan University Department of History. 1985. [西藏自治区文物管理委员会四川大学历史系]. *Karou: A Neolithic Site in Tibet [昌都卡若]*. Beijing: IACASS.

Crawford, Gary, W. 1992. Prehistoric plant domestication in East Asia. In C. Wesley, Cowan and Patty Jo Watson (eds) *The Origins of Agriculture: An International Perspective*, 7-38. Washington and London: Smithsonian Institution Press

Crawford, Gary. W. and Chen Shen. 1998. The origins of rice agriculture: Recent progress in East Asia. *Antiquity* 72(278): 858-866.

Crawford, Gary W, and Gyoung-Ah Lee. 2003. Agricultural origins in the Korean peninsula. *Antiquity* 77(295): 87-95.

Crawford, Gary, Anne Underhill, Zhijun Zhao, Gyoung-Ah Lee, Gary Feinman, Linda Nicholas, Fengshi Luan, Haiguang Yu, Hui Fang and Fengshu Cai. 2005. Late Neolithic plant remains from Northern China: Preliminary results from Liangchengzhen, Shandong. *Current Anthropology* 46(2): 309-317.

Crawford, Gary W, Xuexiang Chen [陳雪香], and Jianhua Wang [王建華]. 2006. Carbonised rice from the Houli Culture site of Yuezhuang, Changqing, Jinan, Shandong [山东济南长清区月庄遗址发现后李文化时期的炭化稻]. *Dongfang Kaogu [东方考古] East Asia Archaeology* 3: 247–251. [in Chinese].

Crawford, Gary W, Xuexiang Chen, Fengshi Luan and Jianhua Wang. 2016. People and plant interaction at the Houli Culture Yuezhuang site in Shandong Province, China. *The Holocene* 26(10), 1594-1604.

d'Alpoim Guedes, Jade. 2011. Millets, rice, social complexity, and the spread of agriculture to the Chengdu Plain and southwest China. *Rice* 4: 104-113.

d'Alpoim Guedes, Jade and Ethan E. Butler. 2014. Modelling constraints on the spread of agriculture to Southwest China with thermal niche models. *Quaternary International* 349: 29-41.

d'Alpoim Guedes, Jade, Ming Jiang, Kunyu He, Xiaohong Wu and Zhanghua Jiang. 2013. Site of Baodun yields the earliest evidence for the spread of rice and foxtail millet agriculture to southwest China. *Antiquity* 87: 758-771.

D'Alpoim Guedes, Jade, Hongliang Lu, Yongxian Li, Robert N. Spengler, Xiaohong Wu and Mark S. Aldenderfer. 2014b. Moving agriculture onto the Tibetan plateau: the archaeobotanical evidence. *Archaeological and Anthropological Sciences* 6: 255-269.

d'Alpoim Guedes, Jade, Guiyun Jin and R. Kyle Bocinsky. 2015. The impact of climate on the spread of rice to north-eastern China: A new look at the data from Shandong Province. *PLoS ONE* 10(6): e0130430. doi:10.1371/journal.pone.0130430.

D'Andrea A. Catherine, Gary Crawford, Masakazu Yoshizaki and Takehisa Kudo. 1995. Late Jomon cultigens in northeastern Japan. *Antiquity* 69: 146-152.

D'Andrea A. Catherine. 1995. Later Jomon subsistence in Northeastern Japan: new evidence from palaeoethnobotanical studies. *Asian Perspectives* 34(2): 195-227.

Dal Martello, Rita, Rui Min, Chris Stevens, Charles Higham, Tom Higham, Ling Qin and Dorian Q Fuller. In prep. Early agriculture at the crossroads of China and Southeast Asia: archaeobotanical evidence and radiocarbon dates from Baiyangcun, Yunnan.

Debaine-Francfort, Corinne. 1988. Archéologie du Xinjiang des origines aux Han. Premiere partie. *Paleorient* 14(1): 5-29.

Deng, Zhenhua, Ling Qing, Yu Gao, Alison Ruth Weisskopf, Chi Zhang, and Dorian Q Fuller. 2015. From early domesticated rice of the Middle Yangtze basin to millet, rice and wheat agriculture: archaeobotanical macro-remains from Baligang, Nanyang basin, Central China (6700-500 BC). *PLoS ONE*: 10(10): e0139885. doi:10.1371/journal.pone.0139885.

Do, Yuho and Gideog Hwang. 1961. *Excavation Report of Jitap-ri Ancient Site*. Pyongyang: Institute of Science.

Dodson, John, R., Xiaoqiang Li, Xinying Zhou, Keliang Zhao, Nan Sun, and Pia Atahan. 2013. Origin and spread of wheat in China. *Quaternary Science Reviews* 72: 108-111.

Dong, Guanghui, Xin Jia, Robert Elston, Fahu Chen, Shuicheng Li, Lin Wang L, Linhai Cai and Chengbang An. 2013. Spatial and temporal variety of prehistoric human settlement and its influencing factors in the upper Yellow River valley, Qinghai Province, China. *Journal of Archaeological Science* 40: 2538-2546.

Flad, Rowan, Shuicheng Li, Xiaohong Wu and Zhijun Zhao. 2010. Early wheat in China: Results from new studies at Donghuishan in the Hexi Corridor. *The Holocene* 20(6): 955-965.

Frachetti, Michael D., Robert N. Spengler, Gayle J. Fritz and Alexei N. Mar'yashev. 2010. Earliest direct evidence for broomcorn millet and wheat in the central Eurasian steppe region. *Antiquity* 84: 993-1010.

Fujian Provincial Museum [福建博物院] and Tanshishan Site Museum [昙石山遗址博物馆]. 2010. A short report on the 2004 excavations at Tanshishan, Minhou County [闽侯昙石山遗址 2004 年考古发掘简报]. *Fujian Wenbo [福建文博]* 2010(1): 1–12. [in Chinese].

Fuller, Dorian and Ling Qin. 2009. Water management and labour in the origins and dispersal of Asian rice. *World Archaeology* 41(1): 88-111.

Fuller, Dorian Q and Ling Qin (unpublished) Botanical work on material from the site of Huitupo.

Fuller, Dorian Q and Hai Zhang. 2007. A preliminary report of the survey archaeobotany of the Upper Ying Valley (Henan Province), In School of Archaeology and Museology, Peking University and Henan Provincial Institute of Cultural Relics and Archaeology (eds) *Dengfeng wangchenggang yizhi de faxian yu yanjiu (2002-2005) [Archaeological Discovery and Research at the Wangchenggang Site in Dengfeng (2002-2005)*, 916-958. Zhengzhou: Great Elephant Publisher. [in Chinese].

Fuller, Dorian Q, Ling Qin, Yunfei Zheng, Zhijun Zhao, Xugao Chen, Leo Aoi Hosoya and Guo-Ping Sun. 2009. The Domestication Process and Domestication Rate in Rice: Spikelet Bases from the Lower Yangtze. *Science* 323(5921): 1607-1610.

Fuller, Dorian Q, Tim Denham, Manuel Arroyo-Kalin, Leilani Lucas, Chris J. Stevens, Ling Qin, Robin G. Allaby, and Michael D. Purugganan. 2014. Convergent evolution and parallelism in plant domestication revealed by an expanding archaeological record. *Proceedings of the National Academy of Sciences U.S.A.* 111(17): 6147-6152.

Furuta, Masataka. 1972. Kureishibaru iseki: Jomon banki noko seisan bunka no shiso. In *Hyakunin linkai Maizo Bunkazai Hokoku* 7: 1-72.

Guangxi Zhuang Autonomous Region Archaeological Team (GZARAT) [广西那坡县感驮岩遗址发掘简报] and Napo County Museum (那坡县博物馆). 2003. A short report on excavations at Gantuoyan in Napo County, Guangxi [广西那坡县感驮岩遗址发掘简报]. *Kaogu [考古]* 2003(10): 899-920. [in Chinese].

Han, Chang-kyun [한창균], Kim G-Y [김근완] and Jajin Koo [구자진]. 2003. *The Neolithic Site at Daecheon-ri, Okcheon-gun [옥천 대천리 신석기유적]*. Daejeon: Hannam University Central Museum [Daejeon]. [in Korean].

Han, Yong [阚勇] and Yunnan Provincial Museum [云南省博物馆]. 1981. Baiyangcun site of Binchuan, Yunnan [云南宾川白羊村遗址]. *Kaogu Xuebao [考古学报]* 1981(3): 349-368.

Hedges, Richard. E. M., Rupert A. Housley, Christopher Bronk Ramsey and Gert Jaap van Klinken. 1992. Radiocarbon dates from the oxford AMS system: Archaeometry datelist 14. *Radiocarbon* 34(1): 141-159.

Henan Institute of Archaeology. 1999. *Wuyang Jiahu*. Beijing: Science. [in Chinese].

Higham, Charles. 1989. *Archaeology of Mainland Southeast Asia: From 10,000 BC to the Fall of Angkor*. Cambridge: Cambridge University Press.

Hubei Provincial Institute of Cultural Relics and Archaeology. 2001. Liulinxi Site at Zigui County, Hubei in 1998. *Chinese Archaeology* 1(1): 88-91. [Originally Published in Chinese. Translation by Li Xinwei and Jiao Tianlong]. Original text: Wang Fengzhu [王风竹], Huang Wenxin [黄文新] and Luo Yunbing [罗运兵]. *考古* 2000(8): 697-706.

Hudson, Mark. 1999. *Ruins of Identify: Ethnogenesis in the Japanese Islands*. Honolulu: University of Hawai'i Press.

Hung, Hsiao-chun and Mike T. Carson. 2014. Foragers, fishers and farmers: origins of the Taiwanese Neolithic. *Antiquity* 88:115-1131.

IA CASS. 2013. 9,000 year old Neolithic site confirmed in Longyu, Zhejiang (Trans. Su Minjie). *Kaogu* 2013-12-09: http://www.kaogu.net.cn/en/News/New_discoveries/2013/1209/44684.html.

Im, Hyo-jai. 1990. Archaeological research of Kimpo Peninsula. A*nnual Bulletin of Seoul National University Museum* 2: 1-22. [in Korean].

Imamura, Keiji. 1996. *Prehistoric Japan*. Honolulu: University of Hawai'i Press.

Ji, Duxue [吉笃学]. 2009. Zhongguo Xibei diqu caiji jingji xiang nongye jingji guodu de keneng dongyin 中国西北地区采集经济向农业经济过渡的可能动因. *Kaogu yu Wenwu 考古与文物* 4: 36-47. [in Chinese].

Jiang, Yuchao. 2011. *Hutuohe shangyou kagou diaocha chutu zhiwu yicun chubu yanjiu [Preliminary Analysis of Plant Remains from Archaeological Regional Survey in the Upper Hutou River Valley)*. Unpublished BA thesis. Peking University, Beijing. [in Chinese].

Jiao, Tianlong. 2007. T*he Neolithic of Southeast China: cultural transformation and regional interaction on the coast*. Youngstown: Cambria Press.

Jiao, Tianlong. 2013. The Neolithic archaeology of southeast China. In Anne P. Underhill (ed) *A Companion to Chinese Archaeology*, 597–611. Hoboken: Wiley.

Jin Hetian, Xu Liu, Rui Min, Xiaorui Li and Xiaohong Wu. 2014. Early Subsistence Practices at prehistoric Dadunzi in Yuanmou, Yunnan: New Evidence for the Origins of Early Agriculture in southwest China. In Anke Hein (ed*.) The 'Crescent-shaped cultural-communication belt': Tong Enzheng's Model in Retrospect: An examination of methodological, theoretical and material concerns of long distance interactions in East Asia*. BAR International Series 2679, 133-140. Oxford: Archaeopress.

Jin, Guiyun, Shengdong Yan, Tetsuro Udatsu, Yufu Lan, Chunyan Wang and Peihua Tong. 2007. Neolithic rice paddy from the Zhaojiazhuang site, Shandong, China. *Chinese Science Bulletin* 52(24): 3376-3384.

Jin, Guiyun [靳桂云], Min Zhao [赵敏], Huaisheng Sun [孙淮生] and Jianbo Sun[孙建波]. 2009. Archaeobotanical investigations of Longshan Cultural Sites in the Chiping Area of Shandong [山东茌平龙山文化遗址植物考古调查]. *Dongfang Kaogu [东方考古]* 2009(6): 317–320. [in Chinese].

Jin, Guiyun, Wenwan Wu, Kesi Zhang, Zebing Wang, and Xiaohong Wu. 2014. 8000-Year old rice remains from the north edge of the Shandong Highlands, East China. Journal of Archaeological Science 51: 34-42.

Jin, Guiyun, Mayke Wagner, Pavel E. Tarasov, Fen Wang and Yanchang Liu. 2016. Archaeobotanical records of Middle and Late Neolithic agriculture from Shandong Province, East China, and a major change in regional subsistence during the Dawenkou Culture. *The Holocene* 26(10): 1605–1615.

Jin, Hetian [金和天]. 2014. *Haimenkou yizhi zhiwu yicun zonghe fenxi 海門�遺址�物遺�綜�分析*. PhD Dissertation, Peking University, Beijing. [in Chinese].

Junwu Shu, Weiming Wang, Leping Jiang and Hikaru Takahara. 2010. Early Neolithic vegetation history, fire regime and human activity at Kuahuqiao, Lower Yangtze River, East China: New and improved insight. *Quaternary International 227: 10-21.*

Kagawa, Mitsuo [賀川光夫]. 1971. A study on the origins of agriculture in the Late Jomon. Jomon banki noko no kigen ni kansuru kenkyu [縄文晩期農業の起源に関す研究]. Beppu Daigaku [別府大学] Kokogaku Kenkyu Hokoku 2. [in Japanese].

Kagawa, Mitsuo [賀川光夫]. 1972. Noukou no kigen (The Origin of Agriculture) [農業の起源]. Tokyo: Koudansha. [in Japanese]

Kagawa, Mitsuo. 1973. Primative agriculture in Japan: Latest Jomon agricultural society and means of production. *Asian Perspectives* 16(1): 1-15

Kan, Xuhang [阚绪杭] and Qun Zhou [周群]. 2007. The Neolithic site at Shuangdun, Bengbu. *Kaogu Xuebao 考古学报 (Acta Archaeologica Sinica)* 2007(1): 92-126. [originally in Chinese]. *IA CASS 2014*: Translation Lee Yun-Kuen 李润权: http://www.kaogu.cn/en/Research_work/Settlement_archaeology_and_arch/2014/0808/47093.html

Kang, Hyung-tae, Youn-sik Choo and Kyung-im Na. 1993. Radiocarbon dating and calibration: re-calibration of dates in Northeast Asia. *Journal of the Korean Archaeological Society* 30: 5-61. [In Korean.]

Kasahara, Yasuo. 1982. Nabatake Iseki no Maizo Shushi no Bunseki, Dotei Kenkyu. (Analysis and identification of ancient seeds from the Nabatake site). In Tosu-shi Kyoiku linkai (ed.) *Nabatake*, 354-379. Tosu-shi Kyoiku Iinkai: Tosu-shi.

Kim, Minkoo. 2014. Rice, ethnicity and the collation of archaeobotanical data for prehistoric Korea. Archaeologies: *Journal of the World Archaeological Congress* 10(2): 168-193.

Korea Institute of Heritage. 2008. *Pyeongtaek Sosa-dong site*. Seoul: Korea Institute of Heritage.

Kotani, Yoshinobu. 1972. *Economic Bases during the Later Jomon Periods in Kyushu, Japan: a reconsideration*. Ph.D Thesis, University of Wisconsin. Ann Arbor. Michigan: University Microfilms International.

Kotani, Yoshinobu. 1981. Evidence of plant cultivation in Jomon Japan: Some implications. *Senri Ethnological Studies 9: 201-212.*

Kumar, Ann. 2009. *Globalizing the Prehistory of Japan: Language, Genes and Civilisation*. London: Routledge.

Lee, Gyoung-Ah, Gary W Crawford, Li Liu Li and Xingcan Chen. 2007. Plants and people from the early Neolithic to the Shang periods in North China. *Proceedings of the National Academy of Sciences* 104(3): 1087-1092.

Lee, Gyoung-Ah. 2009. Reviewing the Early Studies of Plant Remains from the Heunamri site. In: Ahn S-M, Lee J-J (eds), 302-310. *Recent Trends of Study on Prehistoric Agriculture*. Seoul: Sahoepyongron.

Lee, Gyoung-Ah. 2011. The Transition from Foraging to Farming in Prehistoric Korea. *Current Anthropology* 52(S4): S307-S329

Lee, Gyoung-Ahn. 2009. Reviewing the Early Studies of Plant Remains from the Heunamri site. In Sung-Mo Ahn and J.J. Lee (eds), 302-310, *Recent Trends of Study on Prehistoric Agriculture*. Seoul: Sahoepyongron. [in Korean].

Leping Jiang and Li Liu. 2006. New evidence for the origins of sedentism and rice domestication in the Lower Yangzi River, China. *Antiquity* 80(308): 355-361.

Li, Haiming, Xinxin Zuo, Lihong Kang, Lele Ren, Fengwen Liu, Honggao Liu , Naimeng Zhang, Rui Min, Xu Liu, Guanghui Dong. 2016. Prehistoric agriculture development in the Yunnan-Guizhou Plateau, southwest China: *Archaeobotanical evidence. Science China Earth Sciences* 59: 1562-1573 (doi: 10.1007/s11430-016-5292-x)

Li, Jin-Feng, Idelisi Abuduresule, Francis M. Hueber, Wen-Ying Li, Xin-Jun Hu, Yue-Zhuo Li and Cheng-Sen Li. 2013. Buried in sands: Environmental analysis at the archaeological site of Xiaohe Cemetery, Xinjiang, China. *PLoSOne* 8(7): e68957.

Li, Kuang-chou. 1983. Problems raised by the K'en-ting excavations of 1977. *Bulletin of the Department of Archaeology and Anthropology* 43: 86-116.

Li, Kuang-chou [李光周]. 1987. *Prehistoric Cultures at Kenting National Park [墾丁國家公園的史前文化]. Taipei [臺北市]: 行政院文化建設委員會*. [in Chinese].

Li, Manyue, Qinghai Xu, Shengrui Zhang, Yuecon Li, Wei Ding and Jianyong Li. 2015. Indicator pollen taxa of human-induced and natural vegetation in Northern China. *The Holocene* 25(4): 686-701.

Lin, Gongwu [林公務]. 2005. A review of Neolithic cultures in coastal Fujian [福建沿海新石器文化綜述]. Fujian Wenbo [福建文博] 4: 41-50. [in Chinese].

Li, Kunsheng and Rui Min. 2014. The site of Haimenkou: New reseach on the chronology of the Early Bronze Age in Yunnan. In Anke Hein (ed.) The 'Crescent-shaped cultural-communication belt': Tong Enzheng's Model in Retrospect: An examination of methodological, theoretical and material concerns of long distance interactions in East Asia. BAR International Series 2679, 123-132. Oxford: Archaeopress.

Liu CJ [刘长江], Jin GY [靳桂云] and Kong ZC [孔昭宸] (2008) *Archaeobotany: Research on seeds and fruits [植物考古-种子果实研究]*. Shandong University Orient Archaeology Research Series. Beijing: Science Press [科学出版社]. [in Chinese].

Liu, Changjiang [刘长江], Guiyun Jin [靳桂云] and Zhaochen Kong [孔昭宸]. 2008. Archaeobotany: Research on seeds and fruits [植物考古-种子果实研究]. *Shandong University Orient Archaeology Research Series*. Beijing: Science Press [科学出版社]. [inChinese].

Liu, Jiangfeng [刘建峰],Junlong Zhang [张军龙], Qiang Guo [郭强], Gaofeng Shi [史高峰], Du Hongyan [杜红艳], Songmei Hu [胡松梅], Qihuang Yang [杨岐黄] and Junxing Liu [刘君幸] Shanxi Provincial Institute of Archaeology [陕西省考古研究院 陕西西安市] and Weinan Municipal Institute of Archaeology & Conservation [渭南市文物保护考古研究所 陕西渭南市]. 2011. Report on Excavations of Xinglefang Site, Huayin, Shanxi [陕西华阴兴乐坊遗址发掘简报]. *Archaeology and Cultural Relics* [*考古与文物*] 2011(6): 33-47. [in Chinese].

Liu, Li and Xingcan Chen. 2012. *The Archaeology of China*. Cambridge: Cambridge University Press.

Liu, Xu [刘旭] and Zongpin Dai [戴宗品]. 2008. Cave life 3000 years ago: Shifudong site, Gengma. [3000 年前的穴居生活：耿马石佛洞遗址] 2008. *Chinese Cultural Heritage [中国文化遗产]* 2008(6): 84-87. [in Chinese].

Long, Tengwen and David Taylor. 2015. A revised chronology for the archaeology of the lower Yangtze, China, based on Bayesian statistical modelling. *Journal of Archaeological Science* 63: 115-121. (including supplementary tables)

Lu, Houyuan, Jianping Zhang, Kam-biu Liu, Naiqin Wu, Yumei Li, Kunshu Zhou, Maolin Ye, Tianyu Zhang, Haijiang Zhang, Xiaoyan Yang, Licheng Shen, Deke Xu, and Quan Li. 2009. Earliest domestication of common millet (*Panicum miliaceum*) in East Asia extended to 10,000 years ago. *Proceedings Natural Academy Sciences U.S.A.* 106(18): 7367–7372.

Lu, Tracey L. D. 1998. Some botanical characteristics of green foxtail (*Setaria viridis*) and harvesting experiments on the grass. *Antiquity* 72, 902-907.

Lu, Tracey L. D. 1999. *The Transition from Foraging to Farming and the Origin of Agriculture in China*. BAR International Series 774. Oxford: British Archaeological Reports.

Lu, Tracey L-D., Zhijun Zhao and Zhuo Zheng. 2006. The prehistoric and historic environments, vegetations and subsistence strategies at Sha Ha, Sai Kung. In Antiquities and Monuments Office, HKSAR (ed.) *The Ancient Culture of Hong Kong-Archaeological Discoveries in Sha Ha, Sai Kung*, 57-64. Hong Kong: Government Logistics Department.

Luan, Fengshi [栾丰实], Guyun Jin [靳桂云], Fuqiang Wang [王富强], Kazou Miyamoto [宫本一夫], Tesuro Udatsu, [宇田 津撤朗], [Hiroyuki Tasaki [田 崎博之]. 2007. Preliminary study of rice remains from the Yanjiaquan Site, Qixia County in Shandong [山东栖霞县杨家圈遗址稻作遗存的查 和初步研究]. *Kaogu [考古]* 2007(12): 78-84. [in Chinese].

Ma, Ting, Zhuo Zheng, Barry V. Rolett, Gongwu Lin, Guifang Zhang and Yuanfu Yue. 2015. New evidence for Neolithic rice cultivation and Holocene environmental change in the Fuzhou Basin, southeast China. *Vegetation History and Archaeobotany* 25(4): 375-386.

Ma, Xiaolin. 2005. *Emergent Social complexity in the Yangshao Culture: Analyses of settlement patterns and faunal remains from Lingbao, Western Henan, China*, BAR International Series 1453. Oxford: Archaeopress.

Maloney, Bernard K. and John J. McAlister. 1990. Khok Phanom Di, Central Thailand: chemical analysis of pollen core KL2 an AMS radiocarbon dates from cores KL2 and BMR 2. *Geoarchaeology* 5(4): 375-382.

Matsutani, Akiko. 2006. Identification of carbonized grain on the pottery from Ryugasaki A site using SEM observation. In Shiga prefecture board of Education (ed.) *Ryugasaki A Site*, 173-178. Ohtsu: Shiga Prefecture board of Education. [in Japanese].

Minkoo Kim, Sung-Mo Ahn and Youjin Jeong. 2013. Rice (Oryza sativa L.): Seed-size comparison and cultivation in ancient Korea. *Economic Botany* 67(4): 378-386.

Miyata Yoshiki, Takanobu Kojima, Akiko Matsutani, Shin Onbe, and Toyohiro Nishimoto. 2007. Oldest common millet from western Japan: Carbonized material adhering to pottery from the Ryugasaki A site, Shiga prefecture. In: Mineo Imamura M. and Kenichi Kobayashi (eds). *Bulletin National Museum Japanese History 137*, 255-265. Chiba: National Museum Japanese History. [in Japanese with English abstract].

Nakamura, Toshio. 2007. Precise radiocabon dating method by updated AMS machine, in Chengtoushan in Lixian. In Jiejun He and Yoshinori Yasuda (eds.) *Sino-Japanese Cooperative Research on Environmental Archaeology in the Liyang Basin*, 181-186. Beijing: Wenwu Press.

Nanjing Museum and Jiangsu Province Institute (2016) *Shunshanji*. Science Press, Beijing

Nasu Hiro and Momohara Arata. 2016. The beginnings of rice and millet agriculture in prehistoric Japan. *Quaternary International* 397: 504-512.

Nasu Hiro, Arata Momohara , Yoshinori Yasuda and Jiejun He. 2007. The occurrence and identification of *Setaria italica* (L.) P. Beauv. (foxtail millet) grains from the Chengtoushan site (ca. 5800 cal B.P.) in central China, with reference to the domestication centre in Asia. *Vegetation History and Archaeobotany* 16(6): 481-494.

Natapintu, Surapol. 1991. Archaeometallurgical Studies in the Khao Wong Prachan Valley, Central Thailand. *Bulletin of the Indo-Pacific Prehistory Association* 11: 153-158.

Nishida, Masaki [西田正規]. 1975. Identification of seeds [物種子の同定] In Makoto Watanabe (ed.) *Report on excavations at the Kuwagaishimo Site, Maizuru, Kyoto. [京都府舞鶴市桑飼下遺跡発掘調査報告書舞鶴市]*, 244-249. Kyoto: Heian Hakubuttsukan. [in Japanese].

Nishotmito, Toyohiro (ed). 2007. *From the Jomon to the Yoi Period: The beginning of the Early Yaoi (Volume 2), [縄文時代から弥生時代へ新弥生時代のはじまり第 2 巻]*. Tokyo: Yuzankaku [雄山閣]. [in Japanese].

Obata, Hiroki [小畑弘己著]. 2011. *Ancient plant lore in northeast Asia and Jomon cultivation. [東北アジア古民族植物学と縄文農耕]*. Doeisha: Tokyo. [in Japanese].

Oxenham, Marc F., Philip J. Piper, Peter Bellwood, Chi-Hoang Bui, Khanh Trung Kien Nguyen, Quoc Manh Nguyen, Fredeliza Campos, Cristina Castillo, Rachel Wood, Carmen Sarjeant, Noel Amano, Anna Willis and Jasminda Ceron. 2015. Emergence and Diversification of the Neolithic in Southern Vietnam: Insights from Coastal Rach Nui. Journal of Island & Coastal Archaeology 10(3): 309-338.

Pan, Yan. 2011. *Resource Production in the Yangzi Delta and Qiantang Drainage Basin from 10000 to 6000 BP: Palaeoethnobotanical and Human Ecological Investigations*. Unpublished Ph.D. Thesis, Department of Cultural Heritage and Museology, Fudan. University of Shanghai, China [In Chinese with English Abstract].

Pei, Anping. 1996. (On Pengtoushan Culture). In He Jiejun (ed.), *Essays on Prehistoric Cultures of the Middle Yangzi River Valley and the Second Meeting on Asian Civilization*, 81-104. Changshan: Yuelu Press. [in Chinese].

Pigott, Vincent C, Karen M. Mudar, Lisa Kealhofer, Steven Weber and Judy C. Voelker. 2006. A program of analysis of organic remains from prehistoric copper-producing settlements in the Khao Wong Prachan Valley, central Thailand. In Elizabeth A. Bacus, Ian C. Glover and Vincent C. Pigott (eds) *Uncovering Southeast Asia's past, 154-167.* Singapore: NUS Press.

Qin, Ling. 2009. The Nanjiaokou site 2007 excavated Early to Mid Yangshao plant remains. In Henan Provincial Institute of Cultural Relics and Archaeology (ed) *Nanjiaokou site in Sanmenxia*, 427-435. Beijing: Science Press.

Qin, Ling and Dorian Q Fuller. 2009. Discussion on Plant Remains of Early and Middle Yangshao Period from Nanjiaokou Site, Henan Province and the Related Topics. In: Henan Provincial Institute of Archaeology and Cultural Relics (eds). *Sanmenxia Nanjiaokou*, 427-435. Beijing: Science Press. [in Chinese]

Qiu, Zhenwei, Baoshan Liu, Yiquan Li, Xue Shang and Hongen Jiang. 2016. Analysis of plant remains at the Neolithic Yangjia Site, Wuxi City, Jiangsu Province (East China). *China Earth Sciences* 59(9): 1803-1816.

Ren, Shinan. 1996. Several major achievements in Early Neolithic China, ca. 5000 BC. Trans. by Wing Kam Cheung. *Kaogu* 1996: 37-49.

Rispoli, Fiorella. 2007. The Incised and impressed pottery style of mainland Southeast Asia: Following the paths of Neolithization. *East and West* 57(1): 235-304.

Sergusheva, Elena A. and Yury E. Vostretsov. 2009. The advance of agriculture in the coastal zone of East Asia. In Andrew S. Fairbairn and Ehud Weiss (eds) *From Foraging to Farming: Papers in Honour of Gordon C. Hillman*. Oxford: Oxbow Books, 205–219.

Shang Xue [尚雪], Zhang Pengcheng [张鹏程], Zhou Xinying [周新郢] et al. .2012. 陕西下河遗址新石器时代的早. [Agricultural activities at the Early Neolithic site of Xiaohe, Shanxi]. *考古与文物 [Archaeology and Cultural Relics]* 2012(4): 55-59. [in Chinese].

Shelach-Levi, Gideon. 2015. *The Archaeology of Early China: From pre-history to the Han Dynasty*. Cambridge: Cambridge University Press.

Shelach, Gideon and Mingyu Teng. 2013. Earlier Neolithic Economic and Social Systems of the Liao River Region, Northeast China. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology*, 37-54. Oxford: Blackwell.

Shoda, Shin'ya. 2010. Radiocarbon and archaeology in Japan and Korea: what has changed because of the Yayoi dating controversy? *Radiocarbon* 52(2-3): 421-427.

Song Jixiang. 2011. *The agricultural economy during the Longshan period: an archaeobotanical perspective from Shandong and Shanxi*. Unpublished PhD Thesis. UCL. London.

Spengler, Robert, Michael Frachetti, Paula Doumani, Lynne Rouse, Barbara Cerasetti, Elissa Bullion and Alexei Mar'yashev. 2014. Early agriculture and crop transmission among Bronze Age mobile pastoralists of Central Eurasia. *Proceedings of the Royal Society B*. 281: 20133382.

Takahashi, Ryuzaburou. 2009. Symbiotic relations between paddy-field rice cultivators and hunter-gatherer-fishers in Japanese prehistory: Archaeological considerations of the transition from the Jomon Age to the Yayoi Age. *Senri Ethnological Studies* 73: 71-98.

Thompson, Gill B. 1996. *The Excavation of Knok Phanom Di, Volume IV. Subsistence and Environment: The Botanical Remains (The Botanical Remains III)*. *Reports of the Research Committee of the Society of Antiquities of London*. LIII. London: Society of Antiquities

Tosu-shi Kyoiku Iinkai [鳥栖市教育委員会] (ed.). 1982. *Nabatake*. Tosu-shi: Tosu-shi Kyoiku Iinkai. [in Japanese].

Tsang, Chen-hwa [臧振華], Kuang Ti-Li [李匡悌] and Cheng-Yi Chu [朱正宜]. 2006. *先民履跡 [Footprints of Ancient People: Archaeological Discoveries in the Tainan Science Park]*. Hsin Yin: Tainan County Cultural Bureau. [in Chinese].

Tsang, Chen-hwa, Kuang-ti Li, Tze-fu Hsu, Yuan-ching Tsai, Po-hsuan Fang and Yue-le Caroline Hsing. 2017. Broomcorn and foxtail millet were cultivated in Taiwan about 5000 years ago. *Botanical Studies* 58(3): DOI 10.1186/s40529-016-0158-2

Underhill, Anne P, Gary F Feinman, Linda M. Nicholas, Hui Fang, Fengshi Luan, Haiguang Yu and Fengshu Cai. 2008. Changes in regional settlement patterns and the development of complex societies in southeastern Shandong, China. *Journal of Anthropological Archaeology* 27: 1-29.

Vanna, Ly. 2001. Recent archaeological research in the floodplain of the Tongle Sap River: the shell midden site of Samrong Sen and its pottery characteristics. *Journal of Southeast Asian Archaeology* 21: 47-81.

Vanna, Ly. 2002. Rice remains in the prehistoric pottery tempers of the shell midden site of Samrong Sen: Implications for early rice cultivation in Central Cambodia. *Aséanie* 9(1): 13-34.

Vincent Brian. 2003. Rice in pottery: new evidence for early rice cultivation in Thailand. *Bulletin of the Indo-Pacific Association* 23: 51-58.

Wang, Haiyu [王海玉], Yanchang Lui [刘延常] and Guiyun Jin [靳桂云]. 2011. Analysis of carbonized remains from the Dongpan site, Linshu County, Shandong in 2009 [山东省临沭县东盘遗址 2009 年度炭化植物遗存分析]. *Dongfang Kaogu [东方考古]* 8: 357–372. [in Chinese]

Wang, Jihua. 1984. Charred foxtail millets found in the Shawoli site, Xinzheng. *Agricultural Archaeology* 1984(2): 194–207. [In Chinese.]

Wang, Zenglin [王增林] and Jia'an Wu [吴加安]. 1998. Phytolith analysis of the Yuchisi site - Characterizing the prehistoric agricultural economy of the Yuchisi site [尉迟寺遗址硅酸体分析 - 兼论尉迟寺遗址史前农业经济特点]. *Archaeology Kagou* 1998(4): 87-93. [in Chinese].

Wasano Kikuo. 1995. Higasi Asia no kodai ine to insaku kigen [Ancient rice in East Asia and the origin of rice agriculture]. In Kikuo Wasano (ed.), *Genetical and Archaeological Investigation on the Origin of Cultivated Rice and Ancient Rice Culture in East Asia*. Report submitted to the Japan Society for the Promotion of Science. [in Japanese].

Weber, Steve, Heather Lehman, Timothy Barela, Sean Hawks and David Harriman. 2010. Rice or millets: early farming strategies in prehistoric central Thailand. *Archaeological and Anthropological Sciences* 2(2): 79-88.

Weisskopf Alison R. 2014. *Millets, rice and farmers: phytoliths as indicators of agricultural, social and ecological change in Neolithic and Bronze age central China*. BAR International Series 2589. Oxford: Archaeopress.

Wu, Wenwan, Xinghua Wang, Xiohong Wu, Guiyun Jin and Pavel E. Tarasov. 2014. The early Holocene archaeobotanical record from the Zhangmatun site situated at the northern edge of the Shandong Highlands, China. *Quaternary International* 348: 183-193.

Wu, Xiaohong, Ling Qin and Guoping Sun. 2011. 14C chronological data for the Tianluoshan Site. In The Center for the Study of Chinese Archaeology, Peking University (ed.), *Integrated Studies on the Natural Remains from Tianluoshan*. Beijing. Cultural Relics Press, 40-46. [in Chinese].

Wu, Yaoli. 1996. Prehistoric rice agriculture in the Yellow River Valley. *Bulletin of the Indo-Pacific Prehistory Association* 15: 223-224.

Xiang, Anqiang [向安强] and Jinhong Yao [姚锦鸿]. 2006. Discusion and related issues on the discorvery of ancient cultivated rice from Xinghuahe, Fengkai, Guangdong.[广东封开杏花河发现的古栽培稻及相关问题探讨]. *Nongye Kaogu [Agricultural Archaeology] [农业考古]* 2006(1): 33-45. [in Chinese].

Xiao, Minghua [肖明华]. 1995. 云南剑川海门口青铜时代早期遗址. *Kaogu* 1995: 3-15.

Xie, Liye, Steven L. Kuhn, Guoping Sun; John Olsen, W., Yunfei Zheng, Pin Ding and Ye Zhao, 2015. Labor Costs for Prehistoric Earthwork Construction: Experimental and Archaeological Insights from the Lower Yangzi Basin, China. *American Antiquity* 80(1): 67-88.

Xue, Yining [薛轶宁]. 2010. *云南剑川海门口遗址 植物遗存初步研究 [Preliminary results of the analysis of plant remains from the Haimenkou site, Jianchuan, Yunnan]*. Unpublished Masters Thesis. Peking University, Beijing. [in Chinese).

Yan, Wenming [严文明]. 1989. On the origins of rice agriculture in China [再论中国稻作农业的起源]. *Nongye Kaogu* [*农业考古*] 1989(2): 72-83. [n Chinese].

Yang, Ruiping, Yimin Yang, Wenying Li, Yidilisi Abuduresule, Xingjun Hu, Changsui Wang and Hongen Jiang. 2014. Investigation of cereal remains at the Xiaohe Cemetery in Xinjiang, China. *Journal of Archaeological Science* 49: 42-47.

Yang, Shi-Ting. [杨式挺]. 1978. Cultivated rice in Shixia [谈谈石峡发现的栽培稻遗迹]. *Wenwu [文物* 7: 23-28. [in Chinese].

Yang, Xiaoyan, Weiwei Wang, Yijie Zhuang, Zhao Li, Zhikun Ma, Yongchao Ma, Yong Cui, Jun Wei and Dorian Q Fuller. 2016. New radiocarbon evidence on early rice consumption and farming in South China. *The Holocene: DOI: 10.1177/0959683616678465*

Yoon, Seo Suk. 2001. *History of food culture in Korea*. Korea: Shin-kwang Publishing.

Yunfei Zheng, Gary W. Crawford, Leping Jiang and Xugao Chen. 2016. Rice Domestication Revealed by Reduced Shattering of Archaeological rice from the Lower Yangtze valley. *Scientific Reports* 6: 28136; doi: 10.1038/srep28136 [2016].

Zhang, Chi and Hsiao-chun Hung. 2010. The emergence of agriculture in southern China. *Antiquity* 84: 11-25.

Zhang, Chi and Hsiao-chun Hung. 2013. Jiahu 1: earliest farmers beyond the Yangtze River. *Antiquity* 87(33): 46-63.

Zhang, Heng and Haiming Wang. 2005. 浙江嵊州小黄山遗址发现新石器时代早期遗存 (Early Neolithic remains found at Xiaohuangshan site, Shengzhou, Zhejiang). *Zhongguo Wenwu Bao [中国文物报*] (China Cultural Relics News) 2005 Sep. 30: 1-2.

Zhang, Wenxu [张文绪], Cheng Qiuli [邱立诚], Shi-Ting Yan [杨式挺] and Dongfang Xiao [肖东方]. 2006. Study of ancient rice from the Shixia site, Maba, Qujiang, Guangdong Province [广东曲江马坝石峡遗址古稻研究]. *Acta Agronomica Sinica [作物学报]* 32(11): 1695-1698. [in Chinese].

Zhang, Wenxu [张文绪], Anqiang Xiang [向安强], Licheng Qiu [邱立诚] and Jinhong Yao [姚锦鸿]. 2008. Studies on bi-peaked tubercles on the lemmas of ancient rice from the site of Jiuquhoushan, in the Xinghuahe Valley, Fengkai County, Guangdong Province [广东省封开县杏花河旧屋后山遗址古稻双峰乳突及稃壳印痕研究]. *Chinese Journal of Rice Science [中国水稻科学]*: 22(1): 103-106.

Zhang, Zhiheng. 1998. Origin of rice agriculture on the Middle and Lower Yangtze River. *Agricultural Archaeology [农业考古]* 1998(1): 206-211. [in Chinese] Published online in English. Translation Yu Chen, B Gordon. http://http-server.carleton.ca/~bgordon/Rice/papers/ZHNGZ98.htm

Zhao, Keliang [赵克良], Xiaoqiang Li [李小强], Xinying Zhou [周新郢], John Dodson and Ming Ji [纪明]. 2012. Characteristics of agricultural activies and their impact on the environment at the Xintala Site, Xinjiang, as reconstructed from archaeobotanical remains [新疆新塔拉遗址农业活动特征及其影响的植物指标记]. *Quaternary Sciences [第四纪研究]* 32(2): 219-225. [in Chinese].

Zhao, Zhijun [赵志军]. 2010. Appendix 3: Report on the plant remains from Shifodong [附录三: 石佛洞遗址植物遗存分析报告石佛洞]. In Yunnan Sheng Kaogusuo and Chengdu Shi Wenwu Kaogu Yanjiusuo (eds) *Shifodong in Gengma County [耿马石佛洞]*, 368–373. Beijing: Wenwu Chubanshe (in Chinese).

Zhao, Zhijun [赵志军]. 2007. 公元前 2500 年– 公元前 1500 年中原地区农业经济研究 [Research into the agricultural economy of the Central Plains 2500-1500 BC]. *Keji Kaogu [科技考古]* 2: 1-11. [in Chinese].

Zhao, Zhijun. 2011. New archaeobotanical data for the study of the origins of agriculture in China. *Current Anthropology* 52(S4): S295-S306.

Zhao, Zhijun [赵志军] and Jian Chen [陈剑]. 2011. Results and analysis of flotation at Yingpanshan in Maoxian County, Sichuan [四川茂县营盘山遗址浮选结果及分析]. *Nanfang Wenwu [南方文物]* 2011: 60-67. [in Chinese].

Zhejiang Institute of Archaeology. 2003. *Hemudu*. Beijing: Wenwu Press. [in Chinese].

Zheng Yunfei [郑云飞] and Leping Jiang [蒋乐平]. 2007. The remains of ancient rice unearthed from the Shangshan site and their significance [上山遗址出土的古稻遗存及其意义]. *Kaogu 考古 (Archaeology)* 9, 19-25.

Zheng, Yunfei, Guoping Sun and Xugao Chen. 2007. Characteristics of the short rachillae of rice from archaeological sites dating to 7000 years ago, *Chinese Science Bulletin* 52: 1654–1660

Zheng, Yunfei, Guoping Sun, Ling Qin, Chunhai Li, Xiaohong Wu and Xugao Chen (2009) Rice fields and modes of rice cultivation between 5000 and 2500 BC in east China. *Journal of Archaeological Science* 36: 2609-2616.

Zhou Xinying, Xiaoqiang Li, Keliang Zhao, John Dodson, Nan Sun and Qing Yang. 2011. Early agricultural development and environmental effects in the Neolithic Longdong basin (eastern Gansu). *Chinese Science Bulletin* 56: 762-771.

Zhou, Xingyin, Xiaoqiang Li, John Dodson, Keliang Zhao, Pia Atahan, Nan Sun and Qing Yang. 2012. Land degradation during the Bronze Age in Hexi Corridor (Gansu, China). *Quaternary International* 254: 42-48.

Zhou, Xingyin, Xiaoqiang Li, John Dodson and Keliang Zhao. 2016. Rapid agricultural transformation in the prehistoric Hexi corridor, China. *Quaternary International* 426: 33-41.

Zhu, Yangping. 2013. The Early Neolithic in the Central Yellow River Valley, c. 7000–4000 BC. In Anne P. Underhill (ed.), *A Companion to Chinese Archaeology*, 171-193. Oxford: Blackwell.

Zuo, Xinxin, Houyuan Lu, Jianping Zhang, Can Wang, Guoping Sun and Yunfei Zheng. 2016. Radiocarbon dating of prehistoric phytoliths: a preliminary study of archaeological sites in China. *Scientific Reports* 6: 26769; doi: 10.1038/srep26769 (2016).