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Re-thinking the origin of agriculture through the 'beginnings' in the Japanese archipelago

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ABSTRACT

The way in which we investigate the origin of something is largely determined by the way we intend to understand it. In the case of the origin of agriculture, the situation is further complicated by the tone of the investigation, which is not only determined by how we define and understand the set of human activities characterised and described as agriculture but also influenced by the way in which we define and understand those other beginnings we believe were causally linked to the development of agriculture, that are, the development of complexity, the beginning and spread of language and ethnic groups, and so on. The investigation of the beginning of agriculture in Japan offers us some good cases which show that the uncritical coupling of agriculture with those beginnings not only are erroneous but also hinder the development of nuanced approaches to human-plant/animal interactions and their impact on human society. This paper illustrates those problems by studying Jomon food procurement activities and proposes a way to overcome the problems by introducing the concept of the spatio-temporal organisation of social life and by linking hunting, gathering and farming practices to the spatio-temporal organisations of Jomon and Yayoi social life.

KEYWORDS: origins of agriculture, spatio-temporal organisation of social life, Jomon period, Yayoi period, Japanese archipelago

I. Introduction

An important objective in archaeology is the investigation of many 'origins': the origin of modern humans, the origin of complexity, the origin of warfare, the origin of the state, and so on. Amongst them is the investigation of the origin of agriculture, which has particularly significant and wide-ranging implications connected to a number of other 'beginnings.' For instance, the origin of agriculture is related, often causally, to the development—but not necessarily the origin—of complexity in human social organisation,[1] and it is also often related to the beginning of ethnic groupings, marked by various sociocultural and biological traits, including genetic traits and languages.

The way in which we investigate the origin of something is largely determined by the way we intend to understand it. In the case of the origin of agriculture, the situation is further

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complicated by the tone of the investigation, which is not only determined by how we define and understand the set of human activities characterised and described as agriculture but also influenced by the way in which we define and understand those other beginnings we believe were causally linked to the development of agriculture, that are, the development of complexity, the beginning and spread of language and ethnic groups, and so on. In fact, many of those things perceived to have begun with agriculture are also traits of modern societies. As with many other archaeological pursuits, we unconsciously pursue *our roots* in ever-deeper pasts (e.g. Mizoguchi 2006).

The investigation of the beginning of agriculture in Japan offers us many good cases which show that the uncritical coupling of agriculture (including low-level food production: see Smith 2001) with those beginnings not only are erroneous but also hinder the development of nuanced approaches to human-plant/animal interactions and their impact on human society. In particular, the Japanese case challenges the validity of treating food *production* activities as something fundamentally different from other food *procurement* activities in an *a priori* manner. In terms of the *allocation of time and space* in the *spatio-temporal organisation of social life* (see Mizoguchi 2002, 20–24 for more about this concept), some types of food procurement, such as the gathering, storing, and use of nuts and root plants that require sophisticated de-poisoning for their consumption, occupy as much time-space slots as food production in the organisation of social life, although the labour organisation required may be different (e.g. Watanabe 1984). Accordingly, some food procurement activities can lead to the development of complexity more so than (low-level) food production activities (see Smith 2001 for the concept of 'low-level food production').

This also leads us to question why some types of food production resulted in complexity and stratification whereas others did not. Rice paddy-field agriculture, introduced from the southern coastal regions of the Korean peninsula,[2] led to the rapid development of social complexity and hierarchy in the archipelago. However, the cultivation of rice as a cultigen might have already been conducted in areas of northern Kyushu in the Late Jomon.[3] Even if this were not the case, or if this were conducted in primitive form (i.e. as low-level food production), such as slash-and-burn or that which did not involve tillage, those communities where non-paddy-field rice cultivation is claimed to have been conducted would have almost certainly employed the intensive and sophisticated utilisation of nuts (including *Quercus glauca* アラカシ and *Quercus gilva* イチイガシ) or tubers and root plants (including *Pteridium Aquilinum* わらび, *Arisaema Serratum* テンナンショウ). They would have required the involvement of well-organised work-parties for certain periods of the year, and, in terms of the structuring principle of labour, those tasks would not have been so different from rice paddy-field agriculture. The former, however, did not lead to the degree of social complexity and hierarchy that the latter eventually achieved. It can be said that either low-level food production with a large labour input or intensive and sophisticated food-gathering

activities rarely resulted in the development of social complexity and hierarchy that resulted in complex chiefdoms or ancient states, further reinforcing the notion that the simplistic coupling of food production with the beginnings of 'traits of modern societies' needs deconstructing.

Those initial observations go along with the current trend of rethinking the validity of our tacit, *teleological* belief that food production marked an irreversible, universal, and revolutionary achievement for human beings (Childe 1936). Rather, food production, when it emerged in a community, was *one of the functionally and/or culture-symbolically equivalent choices* available to cope with the (changing) complexity of the social and natural environment.

Drawing upon those tentative thoughts, the following will tackle issues concerning the definition and conceptualisation of 'agriculture' and what separates types of food production that resulted in complexity and hierarchy, culminating in the emergence of chiefdoms or ancient states by referring to investigations of the emergence of agriculture in Japan.

II. What is agriculture, how can it be recognised?

The concept of agriculture is ambiguous and, thus, generates two types of problems: one has to do with its definition and the other with its recognition.

Let us begin with the definition. Agriculture is a type of subsistence, a food procurement activity. Amongst an extremely diverse range of subsistence activities, those recognised as 'agricultural' are perceived (1) to involve various degrees of *control* over the way plants and animals grow and live, and (2) to deal with the plants and animals that are *created* through those activities.

Both control and creation are value-laden and belief-system-dependent concepts, as are the perceptions regarding those concepts. Let us consider the first perception, which seems almost a truism. How can we define 'control'? The way plants and animals grow and live can be 'controlled' by intervening the way they grow and live. Such intervention, however, can take many forms and does not necessarily involve direct intervention to their lifecycle. A good example is the use of root plants by the Owen valley group of the American Southwest (e.g. Smith 2001, pp. 30–33), in which substantial irrigation canals were dug to *help* them grow, but no intervening, such as replanting, artificial seeding, and so on, took place. Such cases make us hesitant to use the word 'control' in describing the condition in which plants grow. In the Owen valley case, this control meant creating its tangible traces, which can certainly be recognized as archaeological remains and, hence, without ethnographic information, it might be presumed that fully developed agriculture was conducted, but that it did not involve intervening or altering the plant's lifecycle.

The controlled burning of forests with thick undergrowth in order to help the growth of such plants as *Pteridium Aquilinum* (わらび), *Arisaema Serratum* (テンナンショウ), and

so on is another example of controlling conditions in which certain plants grow without intervening in their lifecycle. The practice is thought to have begun sometime in the Early Jomon or even earlier[4] (e.g. Hashiguchi 1993, pp. 67–71), because equipment suitable to their use had developed at the time. Their starch had to be de-poisoned before consumption; lithic querns and pounding stones to extract the substance, S-profiled pots used to de-poison them via boiling, hand shovel-shaped lithics used for their digging, and so on developed simultaneously with large settlements in the vicinity of their natural habitats, such as fans on the foot of mountain slopes (e.g. Watanabe 1984).

This is a typical circular argument-based inference, and the current development of starch analyses (e.g. Shibutani 2017) brings us hope for future confirmation and clarification. If the practice was indeed conducted, it would be another case in which the condition was controlled without much intervention to the lifecycle of plants, but which left behind tangible archaeological traces.

Let us now consider 'creation.' One fundamental problem exists on the theoretical level: if agriculture were defined as the activities dealing with the plant and animal species *created*, how would we characterise interventions to the lifecycle of the plants and animals previously untouched by human beings? And what about interventions that do not alter them genetically, morphologically, or the way they grow?

Those very simple thought-experiments lead us to re-consider agriculture as a complex cause-effect relationship between intentional and unintentional human acts and consequent reactions by plants and animals. Such relations include human thoughts (including planning), acts, and their material consequences and plants' and animals' reaction in the form of their behavioural, genotypic, and phenotypic modifications. The ways in which these variables are interconnected are extremely complicated and historical-environmental context-dependent, and recognizing *causal connections* among them requires context-specific approaches. In other words, it is not only almost impossible but also possibly meaningless to attempt to formulate a universal definition of agriculture based upon the way these variables are causally correlated. Various concepts and terms, such as cultivation, gardening, horticulture, husbandry, and so on, have been put forward, and different characterisations and definitions have been given to them. But because of the nature of the problems illustrated above, they are destined to fail (e.g. Smith 2001, pp. 6–14).

To remedy the situation, many have invented or adopted *inclusive* terms and conceptual frameworks. One of the most successful is that proposed by Bruce Smith (2001). His framework is sequential in its outlook, but he carefully differentiates it from an evolutionary one; moreover, he states that each unit comprising the sequence—that is, food gathering, low-level food production without domesticates, low-level food production with domesticates, and agriculture—is the result of a distinct process of human-plant/animal interaction in each region of the world, and not a transitional phase (ibid.).

The framework decouples the above-mentioned variables with one another by deconstructing universal assumptions about the cause-effect relationships between the variables. As long as the framework goes, we do not have to be concerned with how to conceptually differentiate cultivation, horticulture, husbandry, and so on. We can also accommodate the above-mentioned intriguing case of the Owen valley group that involved the construction of extensive irrigation systems but without directly interfering with the lifecycle of plants (ibid., pp. 30–33). The problem is how to differentiate and characterise various forms of low-level food production activities. Smith, probably somewhat heuristically, distinguishes low-level food production with and without *domesticates*. However, the division between domesticates and non-domesticates in terms of *genotypic* and *phenotypic modifications* remains blurred and elusive.[5] Besides, unintentional interventions to the lifecycle of plants and animals, such as the disturbance of their habitats, can result in their genetic changes, so an archaeological subdividing of the spectrum of low-level food production activities, ironically, needs to rely on factors *other than* biological, botanical, or zoological. Still, this does not discredit the importance of general morphogenetic investigations of identifying domesticates and cultigens. On the contrary, we should like to know the mechanism through which genotypic and phenotypic modification takes place. However, in order for such investigations to provide indicators for human intervention, such an endeavour must incorporate collaborations with archaeologists. In other words, meaningful studies of low-level food production activities need to be interdisciplinary and need to investigate the types of human-plant/animal *interactions* that resulted in material *and*/*or* morphological traces.

The mere presence of cultigens implies exactly same type of problem. *Perilla frutescens, var. fruetscens* (エゴマ) and *Lagenaria siceraria, var. gourdo* (ヒョウタン) are likely to have existed as far back as in the Early Jomon. However, it is impossible to determine to what extent they were tended while growing; they are known to easily grow in the wild, and there is no genotypic nor phenotypic differentiation between the tended and grown ones. It is a conceptual challenge: how do we describe cultigens that grow in the wild?

Considering that mobility would have been fairly high in the Early Jomon, and characterised as a form of circular mobility in which different spots with seasonally specific resources are visited, it is unlikely that those *cultigens* were tended throughout their growth process, let alone planted on tilled plots. It is easy to categorise such cases as a low-level food production activity. However, *this activity is likely to have caused no change to the spatio-temporal social life of people*. To what extent they were perceived as distinct from other wild plants or something special is also uncertain, though one might speculate that plants that added a unique taste to daily food were specifically chosen and tended for socio-symbolic purposes (e.g. Miyamoto 2009, p. 205). And, as Christine Hastorf's work clearly exemplifies, this can be a fruitful line of enquiry (e.g. Hastorf 1999). However, unless a trace of their selective use was recognised in archaeological evidence, the idea would remain an

interesting speculation. In any case, the investigation of the significance of such plants must be situated in wider social contexts and investigated with their material remains.

Based on these findings, that forms of low-level food production would have been practised during the Jomon by referring to the presence of cultigens is arguable (cf. D'Andrea *et al.* 1995), leading us in a new direction for future study:

1) we first have to grasp the overall pattern of human acts (and thoughts)
2) to see how it was affected by the way people *interacted* with plants and animals, and, finally,
3) investigate whether the interaction involved their gathering, low-level production, and agricultural utilisation.

In other words, food production should be understood as a *polythetic grouping/assemblage* in the multidimensional matrix of causally correlated factors, including human intentional and unintentional acts, their material remains, and reactions and non-reactions by plants and animals in terms of genotypic or phenotypic modifications.

III. *Spatio-temporal oragnisation of social life* and food procurement/production activities of the Jomon period

Let me go back to the fundamental fact: society and sociality are constituted by the way we organise our lives *spatio-temporally* (cf. Mizoguchi 2002, Chapter 2). Food procurement and production activities occupy a significant portion in the spatio-temporal organisation of social life (ibid.) and significantly influences the way it is structured. In short, the way we interact with plants and animals is established by the spatio-temporal organisation of social life.

As mentioned above, we begin to see cultigens as far back as in the Early Jomon. This roughly coincides with the emergence of the material assemblage that sggests the beginning of the utilisation of root plants, tubers, and nuts, involving the technology of de-poisoning and, with the emergence of fairly stable settlements, suggesting the practice of a circular mobility in which people visit fixed locations in different seasons to use seasonally available resources in their vicinity (cf. Uchiyama 2007). The beginning of the circular mobility pattern may have been both a cause and a consequence of the emergence of such cultigens as *Perilla frutescens, var. fruetscens* (エゴマ) and *Lagenaria siceraria, var. gourdo* (ヒョウタン) that grow well in the wild; the stabilisation of the location of settlements, even if occupied during a particular season, would have created stable habitats around the seasonal settlements for them to grow well. However, the establishment of the circular mobility pattern itself would have been made possible by the beginning of the systematic use of certain resources of high nutrition and balk and relatively stable availability, such as salmon, trout, and nuts across eastern Japan (e.g. Nishida 1989) and carp and nuts across western Japan (e.g. Uchiyama 2007). It is thought that the technology of de-poisoning certain types

of nuts, such as *Quercus acutissima Carr* (クヌギ) and *Cuercus serrata Thunb* (コナラ) and starchy root plants, had been invented by this time. The de-poisoning technology and the circular mobility pattern would have mutually enabled one another by stimulating and accelerating each other's development; and by the Middle Jomon, this positive feedback loop culminated in the establishment of the radiating mobility pattern in which forays were dispatched from the year-round home base to different locations in the landscape to procure seasonally different resources in parts of eastern Japan.

This led to the development of territorial defence activities and the communal ownership of certain resources in fixed spots in the landscape. And it is widely accepted that the scheduling of resource procurement activities and the organisation of suitable labour organisations developed hand in hand. The effect of intentional and unintentional interventions to the ecosystems around the home bases would have become increasingly intensified. Because of past experiences, it is widely assumed, experiments were conducted to better conditions in which plants and animals grow and thrive such as (1) controlled firing of forests to help root plants grow more vigorously, (2) replanting of tubers, and (3) seeding of nuts.[6]

Meanwhile, the number of cultigens excavated from archaeological contexts increased little during this process. Soybean (*Glycine max (L.) Merr.*) is a substantial addition to the list of confirmed cultigens, but again it grows well in the wild. Considering the type of cultigens present, the amount of time-space investment for their growth would have been minimal, that is, not involving tillage and other time-consuming tending activities.

The spatio-temporal organisation of social life and the structure of communication constituted by it can be inferred as follows.

The sophisticated utilisation of various nuts, including the types that require de-poisoning for eating, would have supported the establishment of the radiating type mobility with year-round home bases, with the collection of nuts occurring in autumn. Naturally, their processing would have been carried out during the winter, during the hunting season. Excavated faunal remains and the hunting tool assemblage suggest that hunting activities did not involve expeditionary visits of deep mountain ranges but were instead conducted in the nearby mountain-foot of home bases. Hunting would have constituted male labour, whereas the collecting and processing of nuts would have been conducted by women and children.

Root plants such as *Lycoris radiata* (ヒガンバナ) and Kudzu (*Pueraria lobata*クズ) would have been available from the autumn through the spring. Technology for the extraction of their starch and necessary equipment would have been similar to that for nuts' de-poisoning and would have formed a socio-techno-complex in which female labour and the sharing and inheritance of knowledge amongst women would have been significant.

Hiroyuki Sato, referring to ethnographies, argues that the scale of hunting parties involved

in the hunting activities mentioned above would have been quite small, often accompanied by trained dogs (Sato 2007, pp. 8–10). In that sense, hunting, that was male winter labour, was smaller in scale and less collaborative in its organisation than the collection and processing of nuts and root plants, that was female autumn labour.

The summer months would have been spent fishing; this is also the period when communities relied on stored foods prepared during the autumn and the winter. Various construction works, including wooden structures for the wooden de-poisoning of nuts and the extraction of plant fibre may well have been undertaken during the period, although woodworking is most effective in the winter when the growth of trees is halted. If sea fishing activities were conducted mainly by males, in the summer months the degree of collaboration among males was higher than that in the autumn and winter. It would not have been the case, naturally, for inland communities.

The above speculative reconstruction allows us the following model-building: if a new food procurement or production activity were part of this spatio-temporal organisation, it would need to be undertaken during the summer or when it was light enough not to disrupt the sophisticated gender- and age-based labour organisation of the autumn and winter.

IV. *Spatio-temporal oragnisation of social life* and the adoption of cultigens including rice

Since the beginning of the systematic application of SEM analysis of the modelling of imprints on potsherds, it has been argued that the cultivation of rice, barley (*Hordeum vulgare*), foxtail millet (*Steria italica*), and Japanese barnyard millet (*Echinochloa esculenta*) involving tillage had already been conducted in the Late Jomon (cf. Yamasaki 2005). But because the accuracy of some cases' identification is disputed, it is necessary to exercise caution in the development of this field of research.

Amongst the cultigens, rice and millet are grown during the summer and harvested in early autumn. Thus, it can be fit into the above-mentioned spatio-temporal organisation of social life with *minimal disturbance*. It can also compensate the possible food shortage likely to occur before de-poisoned nuts and starch plants become available. In inland communities not involved in inland water fishing activities, the redundant male labour force can also be allocated to their cultivation. Wheat and barley, however, are sowed in the autumn and harvested in the spring and, hence, cannot be fit into the spatio-temporal organisation, particularly if it required organised tending such as tillage.

Kazuo Miyamoto's work shows that the Late and Final Jomon periods were an 'availability phase' (cf. Zvelebil 1986) in that the mixed cultivation of the above- mentioned species was well underway in the southern part of the Korean peninsula (e.g. Miyamoto 2009, pp. 212–226). The interaction between the fishing communities of southern Korea and northern

Kyushu coastlines, he implies, would have mediated the plants themselves as well as the information of arable cultivation. But this availability phase appears to have continued for some time before the 'beginning' of systematic rice paddy-field agriculture.

Drawing from the arguments presented thus far, I propose that amongst the set of domesticates cultivated in the dry-fields of southern Korea, wheat and barley would have been difficult to adopt because their growing season coincided with the time-space slot in the pre-existing, spatio-temporal organisation of social life—that is, the collecting and using of nuts and root plants and hunting—in which a well-established structuring principle reproduced certain modes of communication. *The rice-growing season, however, coincided with the time-space slot which was not so heavily occupied with food procurement and production with the possible redundant male labour force*. If numerous lithic digging tools excavated from some large settlements on the plateaus of central Kyushu were, as Sumio Yamasaki argues (2005), indeed used as tilling tools, they are likely to have been used for dry-field rice cultivation.

Even if the hypothetical support for the rice dry-field farming thesis were verified, the contents of the assemblage included items that are known to have been used for the processing and consumption of nuts and starchy plants. Therefore, rice dry-field cultivation did not change the availability of foodstuff, in general, and yet the communities sustained themselves very well.

V. Concluding thought: The adoption of rice paddy-field agriculture in the Japanese archipelago as a historically contingent event

Why, then, was systematic rice paddy-field agriculture adopted?

Its adoption as a mode of food production itself was not as important to those who had already been practising the complex, low-level food production activities organically situated in the already established spatio-temporal organisation of social life. The population had experience of planning ahead, allocating work to different gender- and age-groups and, when necessary, putting together collaborative labour and building substantial structures. Therefore, the mode could be fit into a loosely structured spatio-temporal slot with the available labour force for the creation of the necessary conditions for the growth of certain plants and would have been undertaken without serious problems.

The reluctance to adopt the sociocultural traits of the techno-complex directly and material traces of the attempt to translate their meaning into what could be accommodated in the pre-existing structuring principle of communication both suggest that the complex was embraced in a controlled manner (Mizoguchi 2013, pp. 53–103).

There is no space in this paper to delve into the cause of this embracement. What I would like to emphasise today is that it was one in a range of available choices. However, as the

subsequent trajectory of the history of the archipelago shows (e.g. Mizoguchi 2013), its unintended consequences were certainly fateful; rice paddy-field agriculture became the dominant mode of food production and the dominant source and generator of contingencies, and, consequently, the social problems and contradictions that were dealt with altered the structuring principle from a corporate-network-based society to one that was hierarchy-based.

Notes

1. It should be noted, however, that it has become increasingly decoupled with 'agriculture' in its narrow sense; a number of communities, including the Jomon of Japan (see e.g. Habu 2004), conducted only low-level food production (or even only sophisticated food gathering) but developed a degree of complexity.
2. The package of rice paddy-field agriculture-related techniques, tools, and various knowledge is thought to have been introduced by a fairly small number of migrants from the southern coastal regions of the Korean peninsula to spots in the coastal plains of northern Kyushu around 800～600 cal BC (Mizoguchi 2013, pp. 53–103).
3. The SEM analysis of the modelling of imprints on potsherds show the presence of rice grains dating from the second half of the Late Jomon (cf. Yamasaki 2007a; Yamasaki 2007b). However, the accuracy of identification is questioned in some cases (Nakazawa 2007), and the sustainability of arable cultivation involving tillage without the development of soil fertilising technique is also questioned (e.g. Ando 2007).
4. The Jomon period is commonly divided into six periods: the Incipient (c. 12,000–9,500 bp), Earliest (c. 9,500–6,000 bp), Early (c. 6,000–5,000 bp), Middle (c. 5,000–4,000 bp), Late (c. 4,000–3,000 bp), and Final (c. 3,000–2,500 bp). (see Habu 2004, Chapter 2).
5. A good example of this is in the form of a debate over the presence of the 'Yayoi pig' (Nishimoto 1991).
6. Their confirmation, however, is quite difficult: the trace of (1) is being sought as a layer of burnt soil with charcoal fragments; the sudden increase in lithic assemblage of digging tools reflects the intensification of the use of tubers and root plants, including replanted ones (2), but obviously the evidence is highly circumstantial; and the observation that a much narrower range of DNA sequence types is observed amongst the excavated chestnuts from the famous San'nai-Maruyama site than their wild equivalents is cited as evidence of domestication, but still debated.
7. One of the supposed major sources of starch, *Arisaema Serratum* (テンナンショウ), is procured during the summer.

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