A developmental history of West African agriculture

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A developmental history for early West African agriculture

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Abstract

The origins and spread of domesticated cereals in Africa remains poorly understood despite continued efforts. This is partly due to the perennial problem of insufficient research and poor conditions of preservation for plant and animal remains. But, there are also potentially very real reasons for why early domestication continues to elude the archaeological record in West Africa. This paper provides a synthesis of recent research, including genetic, linguistic and archaeological data, to examine what is known, and perhaps what cannot be known, about agricultural development in West Africa. Particular attention is given to the initial spread of domestic pearl millet (Pennisetum glaucum), which appears to have been the key, if not the only, crop being cultivated throughout the Sahelian regions of West Africa between 3000 and 1000 BC. It is argued here that the apparent monocropping of early agricultural systems reflects broad environmental circumstances and deep time cultural trajectories of the region. Furthermore, on the basis of recent evidence from the Lower Tilemsi Valley, it is argued that pearl millet cultivation originated further north in the western Sahara and likely predates the earliest presently known finds by at least 1000 years. Evidence from sub-Saharan regions of West Africa demonstrates that a greater diversity of crops came into use during the 2nd millennium BC. The identification of pearl millet as the earliest domestic crop in this region supports prior hypotheses advocating a northern origin for the agro-pastoral occupation of sub-Saharan West Africa, leading to a “knock-on” effect of local domestication events.

Key Words

West Africa, plant domestication, agriculture, neolithisation, mobility

Introduction

The emergence of agriculture and the transition from foraging to farming represents one of the most important events in human history. While a recent surge in data collection in some parts of the world has led to increasing awareness of regional variability, and greater appreciation for the bearings of climatic and environmental circumstance (Colledge et al., 2004; Vigne 2008), the process of “neolithisation”, particularly in the Near East and Europe, is still, for the most part, embedded in the shift to agriculture. Here, there is evidence co-evolution of plant cultivation and livestock keeping alongside increasing socio-technological change, and whilst this event is clearly characterised by internal diversification, at a broad temporal and geographic scale we can still talk of a “Neolithic transition” (Childe 1936). The evidence from Africa, meanwhile, presents a very different picture. In particular, cereal agriculture appears to be a relatively late phenomenon; the data indicating more than a 3000 year lag between the initial appearance of domesticated animals in the eastern Sahara and the first signs of domestic crops along the western fringes of the Sahara-Sahel borderlands, and even later in Ethiopia. Indeed, the domestication of plants and animals, the emergence of ceramic technology, and the urbanisation of landscapes do not appear synchronously as one package, negating the concept of “neolithisation” as it is used in the Near East and Europe. As noted by Casey (2005, 225) ‘What is being missed in this rush to “neolithicize” the Holocene is the opportunity to investigate a lifeway in which the management of domesticated resources is only one of many options’.

Agricultural modelling in an African context

Modelling the evolution of agricultural economies in Africa demands a more critical understanding of the data. One approach that has become increasingly central to the debate is ethnobotany, i.e. the use of anthropological data to characterise the broad diversity in current food production strategies. Neumann (2005, 249) notes that agricultural practices in Africa tend to cover a vast ‘middle ground’ between hunting and gathering, on the one hand, to intensive agriculture on the other. Greater awareness of traditional land-use systems has led to the terms ‘cultivation’, and ‘intensification’, gaining much support (Haaland 1999; Stahl 1993). Unfortunately, cultivation is almost impossible to identify archaeologically, and instead we have to rely on ethnographic analogy and indirect evidence in order to infer cultivation practices. Nonetheless, it is worth considering the social impact that cultivation may have had on populations who perhaps had little need to domesticate cereals to the point of morphologically changing their size and shape. It is important to bear in mind that lack of domestication i.e. the production of genetic change in plant species, does not negate cultivation, and that various factors may have actually countered the domestication process. High levels of mobility, for example, made necessary by increasingly unpredictable environments or demographic constraints (cf. Marshall and Hildebrand 2002) may, as suggested below, have limited the morphological or physiological changes associated with domestication. Instead, as suggested by Barich (1998), the systematic exploitation and necessary preparation skills of wild cereals would have necessitated
regional sharing and exchange of information, providing a framework for later agro-pastoral developments. Such activities would have played an essential role in what she terms ‘pre-adaptive strategies’ (Barich 1998, 38).

Nonetheless, while investigations into the pre-adaptive conditions for agriculture (Clarke 1976) are clearly of importance, the context of agricultural development in West Africa is quite different to that which is found in the Nile Valley and eastern Sahara. The early to mid-Holocene occupation of the central and western Sahara is comparatively ephemeral, leaving little archaeological trace. Equally, the hydrology of the Niger delta and dense forest cover in sub-Saharan Africa supported low density Holocene populations. Archaeobotanical evidence dating to before 3000 BC is therefore extremely rare, providing little evidence of pre-existing socio-economic strategies. Instead, the pre-existing conditions for West African food production appear to be rooted in the developed pastoral strategies found along the Sahara-Sahel borderlands. As noted by Tafuri et al. (2006, 392), increased mobility levels, prompted by increasing aridity would have included exchanges between groups as a further adaptive strategy, generating broad areas of interaction and herding territories that acted as an apposite vehicle for the spread of plant and animal domesticates.
The primacy of herding and environmental context of early African food production

Set against increasing aridification, climatic conditions in Africa became significantly more erratic during the 5th and 4th millennia BC. Between 3000 and 2000 BC, conditions rapidly deteriorated leading to a distinct dry episode happening around 2200/2000 BC marking the end of the Holocene humid phase and the onset of current arid conditions (Maley 1977, 1980, 1982; Lézine 1991). Whilst these environmental dynamics are likely to have played a central role in the establishment of socio-economic change (McIntosh 1993), they also posed critical barriers to the southward expansion of domesticated resources, supporting what has been referred to as the ‘cattle before crops’ model for early African food production (Marshall and Hildebrand 2002).

Domesticated cattle are present in North Africa by at least the mid-6th millennium BC, although Close (1987, 2001) and Wendorf (Close and Wendorf, 1992; Wendorf et al., 1984, 2001; Wendorf and Schild, 1980) argue for domestic cattle in the eastern Sahara at Bir Kiseiba by c. 9300 BC (9840±380 bp) and Nabta Playa by c. 8000 BC. The claim for these being domestic cattle is argued primarily on ecological grounds i.e. that in light of the associated fauna, conditions would have been too dry to support wild cattle populations (Close and Wendorf 1992, 64). However in osteometric terms it has not been possible to conclusively distinguish between them being domestic or wild (Smith 1986). Furthermore, the earliest dated remains came from surface collections at the site of Nabta Playa E-79-8 and most researchers today tend to view these remains with some scepticism. To add to this debate, it now appears as though cattle were domesticated independently in Africa rather than being imported from the Middle East, strengthening the case for an independent and earlier domestication event in Africa. Grigson (1991, 2000) first hypothesised a common domestic progenitor for modern African cattle derived from a distinct form of African auroch (B. primigenius mauritanicus) that was separate from both the wild aurochs of Europe (B. primigenius primigenius) and traditional Asian zebu stocks (B. primigenius namadicus). Recent work on mitochondrial DNA also demonstrates a divergence in the wild cattle of Europe and Africa dating back as early as 22,000 years ago (Loftus et al. 1994; Bradley and Loftus 2000).

At the site of Nabta Playa E-75-6 a date of 7200 BC (8290±80 bp) is more widely accepted for domestic cattle in the eastern Sahara (Gautier 1984). From here, domestication appears to have spread westwards across the Sahara and southwards along the Nile Valley. The westward trend can be observed in the occupation of the Hoggar, the Tassili, Libya at Ti-n-Torah, Uan Muhuggiag, Murzuq and Ti-n-Hanakaten (Gautier and Van Neer 1982; Aumassip 1986; Aumassip and Taueron 1993), southern Algeria at Meneit (Gautier 1987a) and Adrar Tiouyine, and in Niger at Arlit, Adrar Bous, and Tamaya Mellet (Clark et al. 2008; Smith 1980). Cattle are present at Gabrong and Baradigué in the Tibesti at around 6300 BC (7455±180 bp) (Gautier 1987b), and at Adrar Bous in the Ténéré desert of Niger (Clark et al. 2008), where they have been dated between 4130 and 3400 BC (6325±300 bp).

After 2500 BC deterioration of conditions in the Sahara and southward shift in the position of the Intertropical Convergence Zone prompted the movement of domesticated livestock into Sub-Saharan West Africa. Prior to this, much of the Inland Niger Delta was then a vast swamp, uninhabitable for pastoral groups due to a lack of suitable grazing land, and profusion of associated disease vectors such as Malaria and Trypanosomiasis. These climatic and environmental changes prompted significant population movement. This is seen in areas such as the Tlemcen palaeochannel, which would have provided a virtual corridor for populations moving southwards (Gaussin and Gaussin 1988; Manning 2008). Along with aspects of a broadly shared Saharan material culture, the inhabitants of the Tlemcen Valley also brought with them domestic livestock, including cattle, sheep and goat, and domestic pearl millet (Pennisetum glaucum). During the 2nd millennium BC, the ancient floodplain of the Méma region in central Mali also underwent a major infiltration of people demonstrating cultural affiliations with traditions from the North (MacDonald 1994, 112). The Koubadi Tradition, dated to c. 2000 BC has physical and material cultural roots to the northeast at Hassi el Abiod (Raimbault and Dutour 1989), while the later Ndondi Tossokel Tradition clearly derives from the Chebka/Arienne assemblages from Dhar Tichitt. Although evidence for cultivation is present at Dhar Néma by c. 1700 BC (Fuller et al. 2007), no evidence for domesticated cereals has yet been found in the Holocene occupation of the Méma. This is likely a result of the local hydrological conditions, which would have provided suitable grazing territories on the periphery of the inundated plain, but little in the way of agricultural ground.

Lines of evidence for the origins of domestication

The reconstruction of Africa’s agricultural past demands a multi-disciplinary approach. Although the recovery of well-dated archaeological plant remains is a valuable source of information in the study of early agriculture, much of what is known today about the geographical origins of African crops has been obtained from living plant communities and historical linguistics. Vavilov (1926) pioneered much of this work in Africa, suggesting the East African highlands as the potential cradle of agriculture based on the living diversity of cultivated plants. Vavilov’s theory has since lost much support as it has become apparent that a crop’s diversity does not necessarily mirror its area of origin. More recently, Harlan (1971, 1992) mapped the geographic origins for ten of Africa’s crops according to the distribution of their wild relatives. He proposed a theory of ‘non-centred domestication’ whereby the hypothetical domestication areas were very large and rarely overlapped. For pearl millet (which together with sorghum is today a staple crop in sub-Saharan Africa and...
parts of India) Harlan identified the western Sahara as a centre for domestication.

Harlan’s work has since gained support from genetic evidence. Tostain (1998), for example, undertook isozyme surveys of wild populations and domesticated varieties of pearl millet, identifying enzyme similarity datasets favouring southeast Mauritania as a centre for domestication and/or a stretch from northeast Mali to Lake Chad (see Fuller 2003; Oumar et al. 2008). Recent work in the Lower Tilemsi Valley (Manning et al., in press) lends considerable support to these findings (see below).

Another important source of information used in the reconstruction of Africa’s agrarian history, comes in the form of historical linguistics, defined as the analysis of the relationship between languages, in particular those assumed to be genetically related and to have ‘sprung from some common source’ (Blench 2007). While linguistics have proved successful in establishing secure reconstructions for domestic animals (see Blench and MacDonald 2000), they have proved to be more problematic for the major African cultigens. Nonetheless, the names of some cultivated plants found in the Benue-Congo languages of Nigeria also have Bantu reflexes indicating a West African origin for their domestication (Blench 1996, 2007).

The following section looks in detail at current lines of evidence for select domestic cereals, namely pearl millet (Pennisetum glaucum), cowpea (Vigna unguiculata) and fonio (Digitaria sp.) in West Africa. Although, a full review of African agriculture is beyond the scope of this paper, it is also worth noting a number of plant resources domesticated outside of the West African range. In particular, Harlan (1971) highlights Ethiopia as a centre for the domestication of Enset (Musa ensete and Guizotia abyssinica), Teff (Eragrostis tef) and Finger Millet (Eleusine corocana). The origin of domesticated Sorghum (Sorghum bicolor), meanwhile, has proved difficult in pinning down, with Harlan proposing a broad east-west range between eastern Sudan and Lake Chad.

**Pearl millet (Pennisetum glaucum)**

Pearl millet is a staple cereal of sub-Saharan Africa and parts of India, where it is tolerant of the drier Sahelian/semi-desert zones as well as Savanna regions (as Brunken 1977; Brunken et al. 1977; Harlan 1992; Tostain 1998). It is the only African cereal for which existing archaeobotanical evidence is adequate, and much of what is known today about early agricultural developments in West Africa has to do with the domestication and spread of pearl millet. Following Harlan (1992) and Tostain (1998) it is perhaps not surprising that we find the earliest evidence for morphologically confirmed domesticates on the southern fringes of the western Sahara, at Dhar Tichitt around 1800 BC (Ambland and Pernès 1989) and in the Lower Tilemsi Valley by at least 2000 BC (Smith 1992, 74, Manning 2008, Manning et al., in press). Domesticated pearl millet has also been identified south of the river Niger at Windé Koroji Ouest, dating to the early 2nd millennium BC (Kevin MacDonald, pers. comm.) and at Birimi in northern Ghana (D’Andrea et al. 2001) dating to the same period. Fully domesticated pearl millet, which is a native African crop, is also found in India in the late 3rd millennium BC, highlighting the obvious gaps in our knowledge of early pearl millet agriculture. Was millet being domesticated simultaneously in more than one area? Or do we need to look further back in time for a northern centre of domestication predating these finds?

Recent work in the Lower Tilemsi Valley provides new evidence for the timing and process of pearl millet domestication (Manning 2008, Manning et al., in press). In the early 1970’s Andrew Smith (1974) undertook excavations at the sites of Karkarichinkat Nord (KN) and Karkarichinkat Sud (KS), identifying impressions of domestic pearl millet on surface material at KS (Smith 1992, 74). As noted by Neumann (2005, 259), however, the provenance of these samples is compromised and, in effect, they contribute little to our understanding of the earliest history of this cereal.

In 2005 renewed excavations began in the Lower Tilemsi with the aim to refine the chronology, and investigate the emergence of agro-pastoral communities in this region. Extensive excavations were undertaken at Karkarichinkat Nord (KN05) whilst the southern site proved to be unworkable due to the unconsolidated nature of the deposit. A survey was undertaken of the Karkarichinkat hinterland, covering approximately 20x20km, in which 86 multi-period sites were identified. On the basis of surface material, and shovel testing to assess the stratigraphic integrity, five of the large occupation mounds were chosen for subsequent test excavation. These were Ebelelit (EB07), Tiboubija (TB07), Tin Alhar (TA07), Er Negf (EN07) and Jsmagamag (JS07-1 and JS07-2). In addition to sampling for macro plant remains on site, analysis of the pottery assemblages from the sites of EB07, EN07 and JS07-2, all dating to between 2500 and 2000 BC, revealed that a large number of sherds were tempered with chaff. Casts of the chaff impressions from a sub-sample of these assemblages revealed that pearl millet was the predominant species. Furthermore, eight involucre base impressions with preserved rachis fragments were identified indicating the stalked, non-dehiscent morphotype of the domesticate. Only one possible wild type involucre was noted, although this remains somewhat ambiguous. Although the sample size is small, it suggests the predominance of the domesticated form (i.e. 89% of preserved rachis remains). Direct dating of these sherds as well as a single grain of indeterminate Pennisetum from Karkarichinkat Nord, all produced dates in the later half of the Third Millennium BC, mainly between 2500 and 2000 BC (Table 1). Based on the evidence from other cereals, that non-shattering evolved gradually, over about 1000-2000 years (Fuller 2007; Fuller et al. 2009; Fuller and Allaby 2010), it can be inferred that cultivation began perhaps in the 4th Millennium BC. It is important to note that at the sites where domestic pearl millet has been identified in the Lower Tilemsi valley, it is present from the initial occupation levels, implying that
the incoming population brought with them an established economic suite, including domesticated millet, cattle and ovicaprids.

Finds of domestic millet from the first half of the 2nd millennium BC are widely spread across West Africa, including Mauritania (Amblard and Pernes 1989; Fuller et al. 2007), Mali (MacDonald 1996), Ghana (D’Andrea et al. 2001; D’Andrea et al. 2006), Oursi and Ti-n-Akof in Burkina Faso (Kahlheber et al. 2001; Neumann 1999) and Gajigana in Nigeria (Klee et al. 2004). Already by the end of the 3rd Millennium BC, pearl millet had reached India. Even if we are to assume that pearl millet was domesticated some time before its initial appearance in the archaeological record its early occurrence in India suggests that it spread rapidly eastwards across Africa in regions that as yet have been undocumented by archaeobotany (Fuller 2003), such as the northern savannas of Niger, Chad and Sudan. By the 1st millennium BC, domestic pearl millet is found at Waladé (Dorian Fuller, pers. comm.) and Cubalel (Murray et al. 2007) in Senegal and by the mid to late 1st Millennium BC it had penetrated the Central African forest being present at the sites of Bwambé-Sommet and Abang Minko’o in southern Cameroun (Kahlheber et al. 2009).

**Fonio (Digitaria exilis)**

Fonio remains one of the more elusive African crops, both archaeologically speaking and in regard to its present day status. Despite being cultivated throughout much of West Africa, and considered to be one of the earliest cereal domesticates (see http://inco-fonio-en.cirad.fr), archaeobotanical remains are extremely rare. Fonio has been identified at the site of Kolima Sud Est dating to c. 850 BC, and is argued to be domestic on the grounds of size diminution (Takezawa and Cissé 2004). Otherwise, the only other reliable finds of domesticated fonio come from Cubalel in Senegal, dating to c. AD 500 (Murray et al. 2007). Its current distribution, which is fairly fragmented between Guinea and Lake Chad (Chevalier 1922; Portères

<table>
<thead>
<tr>
<th>Lab ref.</th>
<th>Site</th>
<th>Material</th>
<th>Crop</th>
<th>Domestic status</th>
<th>Date bp</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>OxA-16919</td>
<td>Karkarichinkat Nord</td>
<td>Grain</td>
<td>Pennisetum sp.</td>
<td>Indet.</td>
<td>4011±33</td>
<td>Manning et al., in press</td>
</tr>
<tr>
<td>OxA-X-2264-14</td>
<td>Ebelelit</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3687±30</td>
<td>Manning et al., in press</td>
</tr>
<tr>
<td>OxA-X-2287-26</td>
<td>Er Negf</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3782±28</td>
<td>Manning et al., in press</td>
</tr>
<tr>
<td>OxA-X-2287-27</td>
<td>Er Negf</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3980±31</td>
<td>Manning et al., in press</td>
</tr>
<tr>
<td>OxA-X-2287-29</td>
<td>Jsmagamag (2)</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
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<td>3604±30</td>
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<td>Indet.</td>
<td>4121±31</td>
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</tr>
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<td>GX-29359-AMS</td>
<td>Djiganyai</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3370±40</td>
<td>Fuller et al. 2007</td>
</tr>
<tr>
<td>GX-28140</td>
<td>Djiganyai</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3260±40</td>
<td>Fuller et al. 2007</td>
</tr>
<tr>
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<td>Dhar Tichitt</td>
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<td>Domestic</td>
<td>3500±100</td>
<td>Amblard 1996</td>
</tr>
<tr>
<td>Pa-1299</td>
<td>Dhar Tichitt</td>
<td>Ceramic temper</td>
<td>Pennisetum glaucum</td>
<td>Domestic</td>
<td>3420±120</td>
<td>Amblard 1996</td>
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<tr>
<td>TO-8172</td>
<td>Birimi</td>
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<td>Domestic</td>
<td>3460±200</td>
<td>D’Andrea et al. 2001</td>
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<td>2960±370</td>
<td>D’Andrea et al. 2001</td>
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<tr>
<td>Utc-4906</td>
<td>Ti-n-Akof</td>
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<td>2840±49</td>
<td>Neumann 1999</td>
</tr>
</tbody>
</table>

Table 1: AMS dates for 3rd millennium and 2nd millennium BC finds of domestic pearl millet (Pennisetum glaucum) and cowpea (Vigna unguiculata)
1955; Hili et al. 1997), suggests that it was once spread over a much wider area that has since been taken over by higher yielding crops such as millet and sorghum. Equally, the linguistic evidence indicates an ancient origin (Blench 2007). Certain linguistic isolates for the word fonio suggest the crop was cut off from the main zone of cultivation at an early period (Portères 1955, 1976; Burkhill 1994, 226). However, we have a long way to go before any conclusions can be drawn on the early history of fonio cultivation.

**Cowpea (Vigna unguiculata var. unguiculata)**

Recent discoveries of domestic cowpea in association with Kintampo deposits dating to c. 1700 BC in central Ghana (D’Andrea et al. 2007) provide a critical clue to the domestication process in this part of West Africa. Cowpeas are one of the most important food legume crops in the semi-arid tropics of Africa. They are a drought-tolerant and warm-weather crop, and are also shade-resistant making them today a good intercrop with maize, millet and sorghum. The absence of a wild progenitor outside Africa indicates that cowpea was domesticated somewhere on the African continent. Phylogenetic studies and linguistic evidence indicate tropical West Africa to be the point of origin (Coulibaly et al. 2002; Blench 1996). It is, therefore, intriguing that the finds from central Ghana, which correlate well with the genetic and linguistic data, are broadly contemporary with the pearl millet finds from Birimi.

**Sub-Saharan adaptations of the agro-pastoral package**

Today, theoretical debates surrounding Kintampo origins are vehemently divided between diffusionist and migrationist models (cf. Davies 1980; Posnansky 1984; Stahl 1985, 1993, 2005; Watson 2005). Davies (1980), and more recently Watson (2005) have suggested that the Kintampo complex represents a migration of northern Sahelian populations ultimately derived from Saharan groups. Watson (2005) cites fundamental technological and stylistic differences between the Kintampo tradition and preceding Ppun ceramic styles, representing a distinct discontinuity signalled by the appearance of the Kintampo tradition between 1600 and 1200 BC. In contrast, Stahl has argued for an in situ development of the Kintampo complex (Stahl 1985, 1993) claiming for a syncretic evolution of Kintampo cultural traits based on evidence from the rockshelter site K6. Stahl’s excavation area however is relatively small in contrast to the work undertaken by Watson (2005) at the nearby Boase rockshelter sites. Striking similarities in aspects of the Kintampo material culture with traits from northern Sahelian regions, namely ground stone hachettes, labrets, grooved stones, stone rings and cord based roulettes, further support a hypothesis advocating a northern origin. Domesticated resources, ultimately derived from further north, were also introduced alongside the Kintampo, including sheep, goat, cattle and pearl millet. However, the role of domestic cereals within the Kintampo economic regime is far from being uniform. Wild and domestic comestibles were integrated within a seasonally based economic regime involving residential mobility and food storage, characterising the Kintampo as “low level food producers with domesticates” (D’Andrea et al. 2007: 694). Whilst previously it was thought that the Kintampo were adapted to the forest-savanna ecotone (e.g. Davies 1962; Flight 1976; Posnansky 1984) a number of Kintampo sites are now known from the southern forest of modern Ghana, indicating socio-economic adaptation to the forest/savanna boundary.

The key to what role domestic resources played in Kintampo society, therefore, lies in the adaptive potential of early West African agro-pastoral strategies. In particular, the socio-economic adaptations of Kintampo people appear to have been heavily influenced by the prevailing ecological conditions of the southern savanna/forests (Watson 2005), leading to a shift in the importance of domestic resources and a relatively greater exploitation of available wild resources. Indeed, such malleable socio-economic strategies continue to prevail amongst modern savanna/forest populations, demonstrating fundamental ecological and climatic influences on regional food production strategies. It is these ecological restraints that appear to negate the primacy of cereal agriculture in the African process of “neolithisation”, and more generally speaking, in the diversification of African subsistence regimes. As noted by Marshall and Hildebrand (2002), it is likely that predictability in access to resources prevailed over absolute abundance, leading to a prioritization of domestic animals in the context of North Africa and the Sahara-Sahel borderlands. Further south, continuity in the exploitation of wild resources and gradual development of indigenous savanna agriculture would have also ensured predictability in an area where wild comestibles were in abundance.

**Discussion**

A major obstacle in the study of agricultural development in West Africa is that little is still known about how migrations worked in the past and, more importantly, how they would be represented in the archaeological record. Traditionally, this process of population movement has been seen as happening gradually. Ammerman and Cavalli-Sforza (1973) estimated that the rate of spread of farmers in Europe would have been 15 km per generation. If this rate were applied to the West African savanna-Sahel, we could expect a southward progression covering over 1500 years, which does not appear to have been the case. Instead, the spread of pearl millet was rapid, covering over 1000 km in less than 500 years. Hassan (2000) offers an alternative rate of migration in regard to the movement of pastoral groups in Africa, which he describes as being more of a ‘leap-frog’ movement rather than an advancing ‘wave’ of peoples (Hassan 2000, 74). His model, which takes into consideration both the mosaic-like and unpredictable environment of the African Holocene, predicts that small groups, probably either single families or groups of families, could have travelled a distance of up to 5000 km in 500 years if they only travelled 10 km per year.
In the Lower Tilemsi Valley, Dhar Tichitt, Windé Koroji and at Kintampo complex sites, livestock were a key socio-economic resource, and would have almost certainly played an important role in the initial spread of associated domestic crops. In contrast to other parts of the world, pastoralism, in particular cattle pastoralism along with high levels of group mobility, appears to have been the catalyst for socio-economic change in Africa. That cultivation and eventual domestication occurred in tandem with the development and movement of pastoral groups is perhaps not surprising, and as the dates on domestic pearl millet keep on being pushed back along the Sahara-Sahel borderlands, we evidently need to look northwards, amongst the Holocene herders of the western Sahara for the origins of West African agriculture.

Despite the overarching southward shift in agricultural practices, domesticated cereals in sub-Saharan West Africa do not appear to have been integrated into pre-existing economies either uniformly or irrevocably. Although the Birimi deposits are dominated by pearl millet, suggesting rapid assimilation of the northern domesticate, this is in fact unusual for a Kintampo site. Further to the south Kintampo subsistence consisted primarily of tubers such as yam, as well as oil palm and cowpea (D’Andrea et al. 2001, 346). This diversity in subsistence choices across a single cultural complex raises interesting questions about the role of domestication in this context, indicating a divergence from the monocropping trend observed in northern Sahelian regions. At Gajjanna around Lake Chad and in northeastern Burkina Faso (Breunig and Neumann 2002), the status of pearl millet appears somewhat ambiguous. Although remains of domesticated millet have been dated to the mid-2nd millennium BC, its role within the wider economy is still poorly understood. In both regions, fully domesticated forms of pearl millet are present in the early levels of occupation, indicating an imported origin. But, over time, there is significant variability in the role this crop played. The continued importance of wild grasses negates any sort of deterministic model, suggesting that in some regions domestic forms may only have played a minor role in the wider economy. The linguistic data also points towards a gradual entry of domesticates into subsistence strategies. As noted by Blench (1996, 93) ‘The complex pattern of vernacular terms for crops in the ‘Bantu borderland’ suggests that the development of agriculture was a far from sudden process’. Clearly, a high degree of regionalisation is only beginning to be revealed as greater archaeobotanical datasets become available and communication improves between archaeologists, linguists and geneticists.

References


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