NIGERIA

Archaeobotanical Studies at Nok sites: an Interim Report
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Abstract

Well known for its terracotta art and providing some of the earliest evidence for iron technology in sub-Saharan Africa, the Nok culture of Central Nigeria has received little archaeological attention for many years. Since 2005 a research project at the Goethe University in Frankfurt has focused on the cultural background of the terracotta art, investigating aspects of material culture as well as the economic and environmental context, settlement patterns, and chronological development of the Nok culture.

Samples taken for archaeobotanical studies at various sites yielded few but sufficient plant remains for a preliminary reconstruction of the economy and environment. Based on fruit and seed remains, we tentatively reconstruct a plant exploitation system based on mixed cropping of pearl millet (Pennisetum glaucum) and cowpea (Vigna unguiculata). This system is also known from the Nigerian Chad Basin in the same period and might have been utilized by the Kintampo Culture in the second millennium BC. Fruits of tree species stress the importance of wild resources. The combination of cropping systems based on cereals and pulses with oleaginous fruit exploitation is characteristic for the prehistoric economy of the Sahel and Sudan zones, and we suggest that it was dominant all over the West African savannas at the beginning of the Iron Age. The presence of savanna woodland in the vicinity of the Nok sites is suggested by the first results of charcoal analysis. Assemblages with wood from Fabaceae and Phyllantaceae together with typical Sudanian species like Faidherbia albida and Anogeissus leiocarpa lead us to presume that wood was collected from Isoberlinia woodland.

Introduction

Little is known of the Nok culture in Central Nigeria, which is defined largely on the basis of its outstanding terracotta figurines. Created in the first millennium BC they constitute the oldest preserved traces of sculptural tradition in Africa outside Egypt (Willett 2002: 64) and are regularly included in general pan-African overviews (e.g. Garlake 2002: 109-112; Phillipson 2005: 235-236; Willett 2002: 63-72). Within the Nok figurine material at least three styles have been recognized, which might represent regional or chronological variations (Jemkur 1992: 72). These differences, as well as the lack of scientifically excavated Nok assemblages, have repeatedly provoked discussions around the conceptual use of the term “Nok culture” (Jemkur 1992: 72; Shaw 1981: 56), arguing that it is rather an aggregation of cultural traditions, expressed in a certain manner of manufacturing terracotta art. So far, contextual information for the terracotta figurines is missing and their cultural background, including their function, is largely unknown.

Since the discovery of the first terracotta in 1928 just a couple of scientific excavations have been conducted. Archaeological investigations in Taruga (Figure 1) by Bernard Fagg in the 1960s led to the discovery of some of the earliest evidence for iron technology in sub-Saharan Africa (Fagg 1968; Tylecote 1975). Further excavations of Nok settlement sites in Samun Dukiya (Fagg 1972) and Katsina Ala (mentioned in Fagg 1969 and Shaw 1981) in the 1960s are scantily documented. Since 2005 research on the Nok culture has resumed (Breunig and Rupp 2008; Rupp et al. 2005, 2008). A research project established in 2009 at the Goethe University in Frankfurt (“Development of complex societies in sub-Saharan Africa: The Nigerian Nok culture”) focuses especially on the cultural background of the terracotta figurines, investigating various aspects of material culture as well as the economic and environmental context, settlement patterns and the chronological development of the Nok culture. It is in this framework that the present archaeobotanical studies were undertaken.
Sites Excavated

The area where terracotta attributed to the Nok culture was found covers several hundred square kilometers between the Jos Plateau in Central Nigeria (Figure 1) and the city of Kaduna extending southwards beyond the confluence of the Niger and Benue rivers (Jemkur 1992: 4-6).

Surveys and test excavations conducted by P. Breunig and N. Rupp in the last three years have resulted in the documentation of up to 40 archaeological sites, some of them previously unknown. The character of the recorded sites as well as their environmental settings differ considerably (Rupp et al. 2005, 2008). At four sites, Akura, Janjala, Janruwa and Iddah (Figure 1), test excavations were conducted. One site, Ungwar Kura, has been excavated on a larger scale. The site, apparently a settlement site (Rupp et al. 2008), covers about 15 hectares and stretches over two hills of present-day farmland. Eighteen trenches (Figure 2) were opened revealing find concentrations on the hilltops and cultural deposits of up to 1.3 m. Radiocarbon and thermoluminescence dates place these sites in a chronological framework ranging from 500 BC and 200 AD (Breunig and Rupp 2008).

Environmental Settings

All sites are located in the Northern High Plains, the hilly foreland of the Jos Plateau northeast of the Nigerian capital of Abuja. Relief is undulating with striking granite outcrops and elevations between 300 and 900 meters asl. The region receives annual rainfall of 1300-1400 mm (Adefolalu 2003) and belongs, according to Keay (1953), to the Southern Guinea vegetation zone.

Floristically we are dealing with the Guinea-Congolia/Sudanian regional transition zone (White 1983) which consists of a mosaic of secondary (wooded) grassland, semi-evergreen rain forest and Isoberlinia woodland. Woodlands are open stands of trees at least 8 m tall with a canopy cover of 40% or more and a field layer usually dominated by high grasses; they are not true forests (White 1983). According to Menaut (1983) they are intermediate between forests, which are closed formations defined by their lack of a grass cover, and savannas, which are characterized by a continuous grass cover. According to the Yangambi classification of African savanna biome (as cited in Menaut 1983) the term woodland proper is equivalent to “forêt claire”, and should not be confused with savanna woodland, a different term denoting a type of savanna. However,
the differences between woodland and savanna woodland are mainly in the physiognomy of the trees and in the continuity of the grass cover (Menaut 1983).

At the border of rivers and in deeply incised gorges denser gallery forests are present, often with *Terminalia* sp. Where cultivation is possible, the natural vegetation has been profoundly modified to wooded farmland, with fields including useful trees like *Parkia oliveri* and bush fallows, i.e. woodland in various stages of regeneration (Keay 1953).

According to the “Atlas du Nigeria” tuber crops including yams, manioc and potato as well as maize dominate the agriculture of the wider region (Avav and Uza 2003). The observations made in the vicinities of the sites are slightly different. Pearl millet and fonio (*Digitaria exilis, D. iburua*) are widely grown even on poor soils and terraced slopes, whereas...
the cultivation of yams seems to be confined to better, more profound soils. Manioc, rice and sugar cane are mainly found in favorable locations such as depressions and river banks. Farming of maize and sorghum was not observed during the two archaeobotanical field seasons but informants acknowledged them to be important in local agriculture. The spectrum of crop plants is diversified by pulses like Bambara groundnut, cow pea, beans, groundnut, gourds, and various other legumes with ginger as the most important cash crop. Land use includes animal husbandry and the gathering of wild plants like wild yams and tree fruits.

Material and Methods

Charcoal remains

Samples from three different sites were screened. From Ungwar Kura six samples from unit 1 (UK1) and two from unit 12 (UK12) were analyzed resulting in a total of 202 fragments. Ten very small samples from Iddah yielded only 21 fragments. At both sites the samples had been handpicked during the excavation. The bulk of these samples consisted of clay lumps with little charcoal residue and only a few charcoal fragments. From Janruwa 34 fragments from an archaeobotanical flotation sample (2.5 mm fraction) were analyzed. This processing delivered a satisfactory number of well-preserved fragments.

The fragments were analyzed with a reflected light microscope after manually fracturing them along the three planes of wood (transverse, longitudinal tangential and longitudinal radial). For identification the reference collection of microscopic wood slides of the Frankfurt Archaeobotanical Laboratory, wood anatomical atlases (Normand 1950-1960), and the Frankfurt DELTA anatomical database of African woods (Neumann et al. 2001; Dallwitz 1980) were used, as well as the descriptions on the InsideWood webpage (InsideWood 2004-onwards). The differences between charred and fresh wood (see Prior and Gasson 1993) were taken into consideration during the identification process.

Fruit and seed remains

For the retrieval of botanical macro-remains, sediment samples between 7 and 30 litres each were taken from different features or artificial layers. The total of soil samples taken amounts to 7 in Akura, 13 in Janjala, 5 in Janruwa and 61 in Ungwar Kura. Iddah was not sampled systematically. Processing included dry sieving of the sediment followed by bucket flotation using 2.5, 1.0, and 0.5 mm meshes. In addition, large fruits, seeds and charcoal fragments were handpicked during the excavation.

Subsequent sorting of the samples took place in the Archaeobotanical Laboratory of the Goethe University, Frankfurt. Voluminous samples, especially if deriving from the smaller mesh sizes, were divided into sub-samples. The charred plant remains were identified with the help of a carpological reference collection.

Results

Charcoal remains

Two families are well represented in all sites: Fabaceae, which constitute the largest number of fragments, and Phyllanthaceae (Table 1). The wood of many taxa of the Fabaceae lacks discrete, non-overlapping characters and thus renders it difficult to differentiate between species or even genera. In many cases we can only establish wood-types that comprise several genera, like Detarieae 1, a type that is present in all sites. Apart from typical family characteristics like small vessel groups, vestured pits and crystals in chambered parenchyma cells, the fragments of this type have mostly uniseriate rays and aliform parenchyma (Figure 3). Among others (like Anthonota, Monopetalanthus and Gilbertiodendron) the woods of Isoberlinia and Berlinia species belong to this group. Type Detarieae 2 is quite similar but has broader rays and includes the wood of Isoberlinia and Gilberia type. Other wood types of the Fabaceae family are present in the sites as well.

Among the Phyllanthaceae Uapaca type and Antidesma type are each present in at least two sites (Table 1). Wood of the Antidesma type has scarce paratracheal parenchyma, broad rays, simple perforations, enlarged vessel-ray pits, septate fibres and crystals in rays. In addition to Antidesma species it includes at least Spondianthus preussii and Margaritaria discoidea (syn. Phyllanthus discoideus). The latter has occasional scalariform perforations, but should still be taken into consideration when recognizing Antidesma type, because they are often not visible in smaller fragments. Uapaca
Figure 3: Detarieae 1, charcoal fragment from Janruwa, SEM micrographs. a and b: transverse section, paratracheal, aliform parenchyma; c and d: tangential longitudinal section, mostly uniseriate rays; e and f: radial longitudinal section, mainly homocellular rays.
sp. also has broad rays and enlarged vessel-ray pits, but it lacks septate fibers and has silica in rays rather than crystals. Other Phyllanthaceae are present with single or only a few fragments. The Phyllantaceae have formerly been placed as sub-family within the Euphorbiaceae.

**Fruit and seed remains**

So far, the samples have been studied in part only. Analysis focused on the identification of major components of human diet, including tree products and domesticated crop species, leaving the identification of presumable weed taxa for later examination.

Only two crop species and two tree taxa are well represented with charred fruits and/or seeds (Table 2). Domesticated pearl millet (*Pennisetum glaucum*) is by far the most frequent species. Cow pea (*Vigna unguiculata*), a pulse, occurs in Janruwa and Ungwar Kura, but only in low quantities. One more cereal species, *Eleusine cf. coracana* (finger millet) is represented by isolated finds at Ungwar Kura. Endocarp fragments of the tree taxa *Canarium schweinfurthii* (incense tree or African elemi) and *Vitex* sp. are present in all site assemblages except for Janruwa. They are highly fragmented, which, in the case of *Vitex* sp., precludes further identification. The genus *Vitex* comprises approximately 60 species in tropical Africa, of which *V. doniana* (West African plum or black plum) and *V. madiensis* are the most widespread in the savanna regions north of the rainforest zone (Burkill 2000; Keay 1989; Ky 2008). Both species possess fruits matching morphologically the fragments found, whereas other species have to be excluded because their fruits look completely dissimilar.

The archaeobotanical finds are confidently correlated with the rest of the archaeological assemblage. AMS dates of pearl millet (Figure 4) fall mostly into the period between 800 cal BC and 450 cal BC (two sigma range). The only exception is a sample from Ungwar Kura unit 9, which dates around 400-200 cal BC. A possible explanation is that the site was occupied over a long period of time.

### Table 1: Results of charcoal analysis.

<table>
<thead>
<tr>
<th>family</th>
<th>wood anatomical type</th>
<th>Iddah</th>
<th>Janruwa</th>
<th>Ungwar Kura</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fabaceae</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detarieae 1</td>
<td>(<em>Berlina</em> sp., <em>Isobertlia</em> sp., a.o.)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Detarieae 2</td>
<td>(<em>Guibourtia</em> sp., <em>Afzelia</em> sp.)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>cf. <em>Cynometra vogelli</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dialium type</td>
<td></td>
<td></td>
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<tr>
<td><em>Faidherbia albida</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>cf. <em>Pterocarpus erinaceus</em></td>
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<td></td>
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<td></td>
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<tr>
<td><em>Phyllanthaceae</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Antidesma</em> type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Drypetes</em> type</td>
<td></td>
<td></td>
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<tr>
<td><em>Flueggea virosa/Hymenocardia</em> sp.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Uapaca</em> sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Anogeissus leiocarpa</em></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Khaya</em> sp.</td>
<td></td>
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<tr>
<td><em>Parinari</em> sp.</td>
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</table>
Discussion
Charcoal remains – Tentative reconstruction of the palaeo-environment

We interpret the results of the charcoal analysis as indicating *Isoberlinia* woodlands in the surroundings of the Nok sites. This is based on the assumption that the species comprised within the various wood types are distributed in Sudanian woodlands rather than in Guinean formations. Suitable indicators for savannas and woodlands are the Sahel-Sudanian species *Anogeissus leiocarpus* and *Faidherbia albida*. While *Anogeissus leiocarpus* may form the pioneer fringe of expanding rainforests, *Faidherbia albida* is a tree of dry savanna, if not associated with riparian habitats (Burkill 1995). In this context, the good representation of Detarieae 1 points to the presence of *Isoberlinia* sp. rather than to rainforest taxa, which are included in this type. Other representatives of woodlands in the charcoal assemblage are *Pterocarpus erinaceus* as well as *Parinari* sp. (possibly *P. curatellifolia*) and *Uapaca* sp. (possibly *U. togoensis*). *U. togoensis* may occur in agglomerations throughout *Isoberlinia* woodland (Keay 1953). Together with *Monotes kerstingii*, which has not been identified in the charcoals yet, *Isoberlinia doka*, *I. tomentosa* (syn. *I. dalzielii*), and *Uapaca togoensis* (syn. *U. somon*) are the most abundant and characteristic trees of the Northern Guinea zone (Keay 1953), which lies just slightly to the north of the sites.

According to Keay (1953) the climax vegetation of the Southern Guinea zone, in which the sites are located, probably was a “forêt claire”, i.e. an open forest of fire-tolerant and fire-tender trees with a more or less closed canopy over sparse savanna grasses and fire-tender forest shrubs. Woodland vegetation with *Isoberlinia* and *Uapaca* is typical only for rocky hills. Keay differentiates between woodland and “forêt claire” translating “forêt claire” as “Light Forest” (Keay 1953). However, a few years later woodland and “forêt claire” were referred to as synonyms in the Yangambi classification (after Menaut 1983). White (1983) also proposed that in former times, patches of *Isoberlinia* woodland and *Monotes* woodland occurred naturally on shallow soils in the Guinea-Congolia/Sudanian regional transition zone.

Although the charcoal evidence suggests the presence of woodlands, we cannot differentiate whether they were natural or derived from forests due to anthropogenic pressure, nor how extensive they were. It is possible that only small natural patches of *Isoberlinia* woodland existed on rocky, shallow soils, and that they were selectively exploited as a resource for wood because the trees delivered suitable wood for certain needs, while the “forêt claire” seems to have been exploited to a much lesser extent. In this regard it is interesting that Keay (1953) names *Phyllanthus discoideus* as one of the typical tree species of the “forêt claire” of the Southern Guinea zone in Nigeria. The wood of this species belongs to the *Antidesma* type, found in Ungwar Kura and Iddah, which renders it possible that “forêt claire” was present.

We also have to assume the presence of fields and fallows in the vicinity of the sites. The fruit and seed finds prove the cultivation of different crops, and shifting cultivation probably was practiced.

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Table 2: Presence/absence of fruit and seed remains from Nok sites.

<table>
<thead>
<tr>
<th></th>
<th>Akura</th>
<th>Janjala</th>
<th>Janruwa</th>
<th>Ungwar Kura</th>
</tr>
</thead>
<tbody>
<tr>
<td>trenches analyzed</td>
<td>9</td>
<td>13</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td><em>Pennisetum glaucum</em></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><em>Vigna unguiculata</em></td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td><em>Vitex sp.</em></td>
<td>x</td>
<td>x</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td><em>Canarium schweinfurthii</em></td>
<td>x</td>
<td>x</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>
Fallows are typically exploited for fuel wood (Keay 1953). However, evidence of unambiguous woody fallow species is missing from the charcoal assemblage so far. One reason might be that in fallows within Isoberlinia woodland the major woody taxon is Isoberlinia itself (Keay 1953).

**Fruit and seed remains**

**The plant spectrum**

In spite of the low diversity of the four archaeobotanical assemblages, some conclusions can be drawn. Domesticated pearl millet (Pennisetum glaucum) was the most important cereal. Pearl millet grains are the most frequent archaeobotanical find in all sites (Table 2) and occur with high ubiquity (100%) in Ungwar Kura (Figure 5). In contrast, other cereals like Eleusine cf. coracana (finger millet) are rare, or, like Digitaria spp., have not been discovered at all. The same holds true for the fruits of wild grasses such as wild rice, which might have been gathered in their natural habitats. For the moment, it is impossible to assess if pearl millet was the only staple crop, or if particularly roots and tubers like yams also played an important role in prehistoric agriculture and diet.
Their chances for preservation as macroremains are much poorer than those of cereals, due to usage and processing methods (see Burkill 1985: 654 ff.), which rarely lead to accidental charring and to fragment sizes large enough for identification. Cow pea, only sparsely present in two sites (Ungwar Kura and Janjala), seems to be seriously underrepresented. There are several reasons that might be responsible for preservation problems. First, chances of accidental charring during processing and preparation are rare. For instance, free-threshing pulses like Vigna spp. lack a step in processing (providing a greater opportunity for archaeological preservation) when compared to pod-threshing pulses (compare Fuller and Harvey 2006). In addition, the last step in pulse processing, i.e. parching or dry-roasting (Fuller and Harvey 2006: 259), is in West Africa mostly done by exposing the seeds to the sun and not by using open fire, thus reducing the probability of accidental charring. Consumption preferences influence the archaeological presence of cow pea as well: Burkill (1995) mentions a great number of different preparations in cookery, many of them based on ground seeds or flour. Another point worth mentioning is the charring behavior of pulse seeds. Charring experiments have shown that pulse seeds become completely charred at 500°C whereas cereals are in general more sensitive to high temperatures (Guarino and Sciarrillo 2003). This bias in heat sensitivity for the two plant groups is explained by seed coat morphology and seed size. It can be concluded that conditions that led to the successful charring of cereal grains might have resulted in incomplete carbonization – and subsequent decomposition – of pulse seeds.

The tree taxa Canarium schweinfurthii and Vitex sp. are present in all sites except for Janruwa. The retrieved parts are endocarp fragments, which are extremely solid and robust and therefore possess a high probability for preservation. The absence of other species with less robust fruits or seeds probably indicates extremely selective preservation conditions. The complete lack of threshing remains, which would be expected due to the abundant and ubiquitous presence of pearl millet grains, supports this interpretation. At all Nok sites we are thus dealing with a particularly impoverished species spectrum that does in no way reflect all aspects of plant use.

Economical and ecological interpretation

The fruit and seed finds reveal that the subsistence of the population of the Nok sites studied relied greatly on farming products. Frequent and
ubiquitous pearl millet remains suggest a cereal-based nutrition. Presumably, pearl millet and cow pea were cultivated in mixed cropping systems as traditionally practiced all over the savanna zones of West Africa (Fussell 1992). Today, pearl millet is the most important staple crop in rain-fed agrarian systems of the Sahelian zone because of its physiological and ecological adaptation to dry conditions (Andrews and Kumar 2006). Under higher rainfall regimes, in the Sudanian zone and further south, cereal cultivation includes other species like sorghum, which are grown together with pearl millet in order to minimize the risk of crop failure under unpredictable climatic conditions. Instead, mono-cropping of pearl millet is restricted to marginal grounds with meager soils of low fertility, and where other crops fail to prosper. The poor and stony soils at the slopes and on the hilltops in the immediate surroundings of the archaeological sites belong to such localities and pearl millet must have been the appropriate crop.

Ecologically, cow pea is equally well adapted. The crop copes with a wide range of soil types (Madamba et al. 2006), including infertile land, because it receives a significant amount of its nitrogen requirement from the atmosphere. Generally grown under rain-fed conditions cow pea plays an important role in multiple cropping systems and allows for a certain intensification of agriculture. It is the preferred pulse in large parts of Africa and serves as a cheap source of plant protein. Its value in the nutrition of the Nok people, however, is not easy to assess because faunal evidence is completely missing in the sites, preventing a reconstruction of the inhabitants’ protein supply. Of course, animal keeping might have been problematic in the forest-savanna transition zone due to tsetse infestation, but the simultaneous lack of archaeozoological remains of wild animals indicates difficult preservation conditions. Most probably they are due to the acidic soils with pH-values of 3.9-5.5 in the Ungwar Kura region (KCl medium, H.-M. Peiter pers.comm.). Terracotta figurines occasionally depict wild and possibly also domestic animals like monkeys, elephants, snakes, and sheep etc. (Fagg 1990: 33 ff.) which provides a rough idea of the former fauna which contributed certainly to human nutrition. The use of vegetal protein resources, however, offers greater economical flexibility in the diet.

The tree taxa Canarium schweinfurthii and Vitex sp. probably represent only a small percentage of the wild species collected for food purposes. It is a common feature of modern and prehistoric rural economies in sub-Saharan Africa to combine agricultural activities with the exploitation of wild resources (Neumann 2005). Archaeological sites in the Sahelian and Sudanian zone give evidence for the use of a wide range of wild species (Kahlheber and Neumann 2007), and especially oil or fat containing fruits and seeds are highly valued even today (Harris and Mohammed 2003; Seignobos 1982). Canarium schweinfurthii and many Vitex species like V. doniana or V. madiensis have oleaginous seeds and an edible mesocarp. The fruits of these three species can be eaten raw, dried or roasted, and are suitable for processing into storable products (Burkill 1985, 2000).

Canarium schweinfurthii is found throughout tropical Africa from Senegal to West Cameroon, extending to Tanzania and Angola (Wild 1963). The species is limited to an altitude of 1600 m asl and mean annual rainfalls between 900 and 2200 mm (agroforestation database). It occurs in evergreen and semi-deciduous rain forests, dry, secondary and transitional forests, whereas it is restricted to gallery forests and forested depressions towards the northern limit of its distribution area. In cultivated land, where natural forests were cleared, C. schweinfurthii often remains as isolated tree (Wild 1963).

Vitex species are widespread in sub-Saharan Africa. The two species most frequently encountered in the savanna regions north of the rainforest zone, V. doniana and V. madiensis, occur in a variety of habitats from forest to savanna, in regions with a mean annual rainfall of 750-2000 mm and an altitude of up to 2000 m. They are found on termite mounds and on alluvial soils, but they are also a common component of agroforestry parklands, where trees are retained when clearing forest or savanna bushland for new fields (Arbonnier 2002; Burkill 2000; Keay 1989; Ky 2008).

Canarium schweinfurthii and Vitex species seem to have been abundantly available in the vicinities of the sites. Their usefulness is unquestioned, but their exclusive presence at the Nok sites investigated is likely due to the greater potential for preservation of their durable endocarps than is the case for remains of other species.
CONCLUSION

Archaeobotanical samples taken at the site of Ungwar Kura and during various test excavations at other Nok sites yielded few but sufficient plant remains for a preliminary reconstruction of the economy and environment. We suggest a subsistence strategy based on mixed cropping of pearl millet and cowpea combined with the exploitation of wild trees with oleaginous fruits, being practiced in an environment where woodland was at least partly present. The same economic system was reconstructed for contemporaneous groups in the Chad Basin (Breunig et al. 2006; Magnavita et al. 2004) and might have been applied already by the second millennium BC Kintampo culture where both crop species are evident as well (D’Andrea et al. 2001, 2007; D’Andrea and Casey 2002). It seems that at least by the beginning of the Iron Age, cereal-and-pulse-based cropping systems combined with the exploitation of wild oleaginous fruits were widespread in prehistoric economies of the West African savannas from the Sahel to the forest-savanna transition zone. In some places they even conquered the rainforest zone (Höhn et al. 2007; Kahlheber et al. submitted). All over West Africa pearl millet was the most important and often the exclusive cereal cultivated (Kahlheber and Neumann 2007). In the course of the Iron Age other cereal species were added, but rarely replaced it as a staple. Therefore the finds of possible finger millet in Ungwar Kura would be of particular significance and needs urgent confirmation.

The dominance of a cereal-based economy in Central Nigeria seems to be confirmed by the archaeological assemblages: Grinding equipment is frequently found at many Nok sites (Rupp et al. 2005), and in Ungwar Kura a dense scatter of grinding stones and grinders designates the surface of the entire site. In addition, Nok figurines exist that depict women using querns (Chesi and Merzeder 2006: 24, 100). We are well aware that the authenticity of these objects might be problematic with regard to dating and provenance (see Rasmussen 2006), and that grinding stones might well have been used for other purposes, but considering the results altogether they indicate that cereal cultivation was a common practice at Nok sites. Nevertheless, with problems in preservation, it remains a challenge to trace much of the variety of plant exploitation. In this context, the yam question is most crucial since this tuber crop is of considerable importance in the present-day food economy. As already discussed, it was not possible to trace archaeobotanical remains of yams, and starch analyses of some of the grinding stones were unsuccessful. Methodological problems might be responsible, and grinding stones might not be the best tools to analyze when searching for yams. For instance, there is no ethnographic evidence that they are involved in the yam food preparation process. Mostly, yams are eaten boiled, fried or as fufu, a dough made by pounding the peeled and boiled tubers (Burkill 1985: 655). Only tubers that are not fit for storage are traditionally processed into flour by cutting the tubers into slices, drying and grinding them. The product then is storable. Although grinding is mostly done in wooden mortars, or today by using flour mills (FAO 1990), the utilization of grinding querns is conceivable. Nevertheless, cutting tools or even sediment samples should also be tested for starch residues. Another possibility for the absence of yams traces might be that locations with profound soils suitable for yam cultivation were missing in the direct vicinities of the sites. However, for the moment our archaeobotanical assemblages do not sufficiently inform us on soil qualities.

Environmental settings are decisive in the type of land use and the species cultivated. These species are reflected in the archaeobotanical assemblages. The presence of Canarium schweinfurthii and Vitex species points to the existence of agroforesting systems and/or riparian forests, which were exploited at least for wild fruits. Charcoal analyses suggest the presence of Isoberlinia woodlands, most probably as part of a forest/woodland mosaic. The origin of the mosaic – whether it was natural, due to different soil properties or to geomorphological factors, or anthropogenic, due to the conversion of forest into derived savanna – cannot be estimated yet. Also, the extension of both woodland and forest remains unknown for now.

For the future, phytolith studies promise additional information on the vegetation. A sample from the vicinity of the village of Nok has been analyzed and points to forest vegetation (Neumann, pers. comm.). But since it was taken from alluvial sediment, the nature and extent of this forest remain to be investigated. It is possible that the sample reflects a gallery forest along a watercourse rather than the dominating vegetation type.
Climatic data corroborate that forests should have been present from the middle of the first millennium BC because higher precipitations are indicated for the wider region by a high water level of Lake Bosumtwi (Ghana) around 200 BC (Shanahan et al. 2006) and by the expansion of forest in the Dahomey gap of southern Benin (Salzmann and Hoelzmann 2005). It is reasonable to assume that the Nok area received comparatively higher rainfall during the second half of the first millennium BC as well. Depending on the duration of the dry season and the atmospheric humidity throughout the year, 1300 to 1600 mm annual rainfall would have been sufficient for the development of at least a drier semi-evergreen rain forest, which is present at the borders of the Guineo-Congolian region today (see White 1983).

Outlook

The funding of a new long-term project (“Development of complex societies in sub-Saharan Africa: The Nigerian Nok culture”) by the German Research Foundation (DFG) allows us to continue our research. Archaeobotanical investigations will carry on, focusing on the questions of economic strategies and ecological conditions of the Nok culture. Complete excavations of settlement sites will not only provide us with a larger number of archaeobotanical samples, but also with the possibility of spatial interpretation. Excavating and sampling Nok sites in different environmental settings will help to better understand the economic base of the Nok culture. Other interesting questions for further archaeobotanical research will address the effects of population growth and iron production on the natural environment. The role of vegetation changes, either climatic or anthropogenic, in the rise and fall of the Nok culture will be assessed as well. The collaboration with archaeologists, geographers and geologists will certainly lead to new insights.

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Footnotes

1 Boullier et al. (2002-2003: 26-27) present radiocarbon dates range from 1000-800 BC to 400-200 BC; Jemkur (1992: 67-70) gives thermoluminescence dates that range between 555 ± 210 BC and 570 ± 135 AD.