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Africa's earliest bananas?

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Abstract

The recent discovery of banana phytoliths dating to the first millennium BC in Cameroon has ignited debate about the timing of the introduction of this important food crop to Africa. This paper presents new phytolith evidence obtained from one of three sediment cores from a swamp at Munsa, Uganda, that appears to indicate the presence of bananas (*Musa*) at this site during the fourth millennium BC. This discovery is evaluated in the light of existing knowledge of phytolith taphonomy, the history of *Musa*, ancient Indian Ocean trade and African prehistory.
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1. Introduction

Bananas and plantains are vitally important food crops for people living in the wet tropics. Moreover, the ability of plantains to support high population densities of settled farmers was crucial to the development of some pre-colonial African states, notably Buganda. While there has been some debate about the date of the introduction of bananas (genus *Musa*, family Musaceae) to Africa, until recently almost all scholars would have placed this event well within the last 2000 years. This broad consensus was recently thrown into turmoil with the discovery of phytoliths derived from bananas in refuse pits in an agricultural village site, Nkang near Yaoundé in southern Cameroon, dating to the first millennium BC [30,31]. However, one noted African historian has rejected these new data, arguing that the earliest acceptable evidence for banana cultivation in Africa dates no earlier than the late sixth century AD [60]; a rejoinder rapidly followed [32].

New evidence presented in this paper for the possible existence of bananas at Munsa, Uganda, during the fourth millennium BC considerably raises the stakes of the debate. This paper evaluates the plausibility of this evidence in the light of what is known about the identification and taphonomy of Musaceae phytoliths, the history of bananas, and African and extra-African prehistory.

2. Site description

Munsa is located in the southeastern part of what was the pre-colonial kingdom of Bunyoro, Uganda (Fig. 1: 0° 49′ 30″ N; 31° 18′ 00″ E). The main basement rocks at Munsa are granite intrusions and argillites and quartzites of the Pre-Cambrian Bunyoro-Toro system [16] that occasionally outcrop at the surface forming isolated, rocky hills. Rainfall at Munsa is bimodal, with the onset, intensity and duration of the two wetter periods during the year determined by the annual cycle of circulation over the Indian Ocean [17,18]. Rainfall is also influenced

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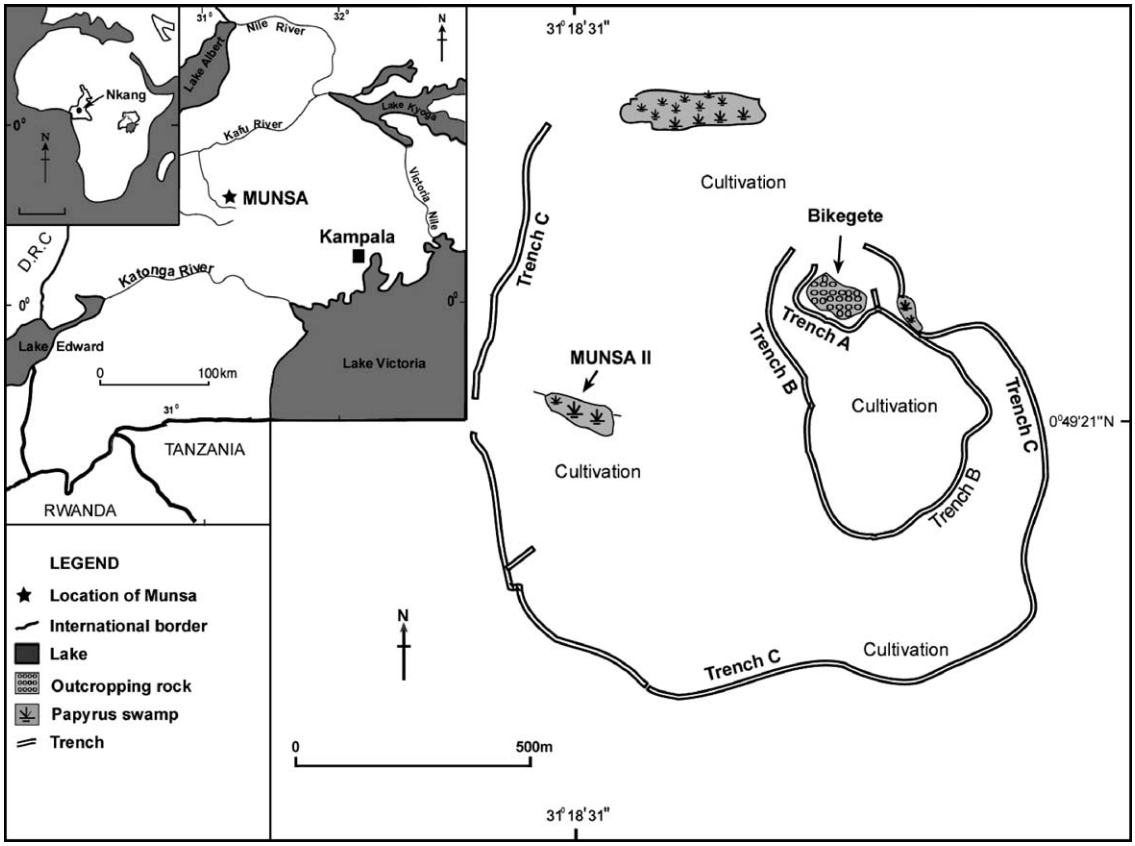


Fig. 1. Map of Uganda showing the location of Munsa. The hill at Munsa (Bikegete) is set within concentric rings of earthworks (trenches) and cultivated land (after Lanning [24]).

by irregularly occurring ENSO-related phenomena [41]. Mean annual rainfall is approximately 1300 mm.

A patchwork of small farms, interspersed with remnants of Medium Altitude Semi-Deciduous Forest (*sensu* ref. [22]), characterizes the area around Munsa, with intervening valley bottoms often occupied by papyrus (*C. papyrus* L.) swamps. Forest remnants include *Albizia* spp., *Celtis africana* Burm. f, *Ficus* spp., *Neoboutonia macrocalyx* Pax and occasionally *Sapium elipticum* (Horchst. ex Krauss) Pax. Patches of tall members of the Poaceae (elephant grass, *Pennisetum purpureum* Schumach., and guinea grass, *Panicum maximum* Jacq.) in association with shorter grasses such as spear grass (*Imperata cylindrica* Beauv.) may represent abandoned farmland and an early stage in the recovery of forest. A range of perennial crops, including banana, and annuals, e.g., beans and grains, is cultivated. Cultivated bananas (varieties of the sweet banana, *Musa acuminata* Colla) are used locally, mainly in the production of beer.

The archaeological site at Munsa occupies about 1 km^2 of land ranging in altitude from 1220 m above mean sea level (amsl) to the highest point (Bikegete, a granite outcrop) at 1340 m amsl [24,47]. The site consists of settlement debris, burials, rock-shelters and evidence of iron working, grain storage and the consumption of cattle centered upon Bikegete and surrounded by three roughly concentric rings of earthworks in the form of trenches. Recent archaeological research suggests that Munsa was first occupied by substantial numbers of people towards the end of the 1st millennium AD and abandoned in the 17th or perhaps 18th century [47,49].

3. Methods

A series of overlapping sediment cores was collected using a Livingstone (piston) corer during fieldwork in 2001 from three locations along a transect at Munsa II, a small papyrus swamp in the area enclosed by the outermost trench (Trench C) of the archaeological site. Cores M2C1 (130 cm long), M2C2 (177 cm long) and M2C3C (185 cm long) were collected, respectively, 0.5 m, 5 m and 13 m from the northern edge of the Munsa II swamp. Sediments in the cores generally consisted of 1–1.5 m of fibrous peat and dark-coloured organic-rich clays over-lying paler clays and fine to coarse basal sand deposits.

A total of 15 AMS radiocarbon (^{14}C) dates were obtained for the three cores (Table 1 and ref. [27]). All the dates are stratigraphically consistent, ranging from

Table 1
AMS ^{14}C dates for Munsa II core M2C3C

Sediment core	Lab number	Depth (cm)	Conventional ^{14}C age (BP)	Calibrated (cal.) ^{14}C age [$\pm 2\sigma$]	Relative area under probability curve	Median cal. ^{14}C age (to nearest 10 years)	Type of material dated
M2C3C	Beta-175370	31–32	540 ± 40	1307–1365 AD	0.361	1400 AD	Plant macrofossils
				1386–1440 AD	0.639		
M2C3C	Beta-168965	45–46	560 ± 40	1303–1368 AD	0.523	1370 AD	Plant macrofossils
				1383–1433 AD	0.477		
M2C3C	Beta-175371	74–75	670 ± 40	1277–1330 AD	0.493	1340 AD	Plant macrofossils
				1342–1396 AD	0.507		
M2C3C	Beta-168965	102–103	850 ± 40	1042–1092 AD	0.131	1200 AD	Bulk sediment
				1118–1140 AD	0.065		
				1154–1276 AD	0.803		
M2C3C	Beta-175372	117–118	910 ± 40	1030–1211 AD	1.000	1110 AD	Plant macrofossils
M2C3C	Beta-185997	137–138	3640 ± 40	2136–2079 BC	0.202	2000 BC	Bulk sediment
				2066–1891 BC	0.798		
M2C3C	Beta-175373	162–163	4560 ± 40	3492–3469 BC	0.042	3220 BC	Bulk sediment
				3373–3261 BC	0.390		
				3241–3100 BC	0.567		

The AMS dates were calibrated using the INTCAL 98 Radiocarbon Age Calibration [58] and the computer programme Calib 4.4. See ref. [27] for information on complete set of AMS ^{14}C dates for Munsa II cores.

3492–3100 BC (4560 ± 40 BP, calibrated at 2σ) to 1654–1949 AD (180 ± 30 BP). Cores M2C1 and M2C2 span approximately the last 2000 and 1250 years respectively, while Core M2C3C covers the longest time period, and appears to contain at least one major hiatus in sedimentation between the calibrated dates of 2136–1891 BC (3640 ± 40 BP) (137–138 cm) and AD 1030–1211 (910 ± 40 BP) (117–118 cm), and possibly a second above 30 cm. Subfossil pollen, fungal spores and microscopic charcoal samples were recovered from all three cores.

Lejju et al. [27] provide a complete description of the AMS ^{14}C chronologies, including age-depth curves used to interpolate and extrapolate ages for sediment core samples, and subfossil data obtained from Munsa II. Here we focus upon the remains of Musaceae-type phytoliths extracted using standard procedures [39,42] from sediment core samples. Phytolith morphotypes were identified according to Rovner [53], Piperno [42], Mbida et al. [31], Denham et al. [11] and Vrydaghs and De Langhe [61], as well as through the collection of type material at the Royal Museum of Central Africa and on the basis of voucher material extracted from specimens collected in the study area.

4. Results

Details of the contents of all three cores are published in Lejju et al. [27]. The correspondence in all three cores between the phytolith data and the other paleoenvironmental indicators is good. In broad terms, the evidence indicates the presence of forest from the base of the sequences until early in the second millennium AD. Forest clearance commencing almost 1000 years ago matches the dating of the main period of occupation of the Munsa archaeological site. After the abandonment of Munsa and its earthworks, probably in the 17th century AD, some forest recovery is evident. Lejju et al. [27] discuss the relative contributions of human activities and climate change to this vegetation history.

Musaceae phytoliths were found in all three cores (Plates F–J). These phytoliths were not always identifiable to the genus level. In Core M2C1 phytoliths of the genus *Musa* (edible bananas and plantains) were largely restricted to sediments whose age, interpolated from the AMS radiocarbon dates, lies within the last two or three centuries. Phytoliths of the genus *Ensete* (false banana, a genus that includes several species that are indigenous to equatorial Africa) were identified in a sample from this core with an extrapolated (calibrated) age of about the 7th century AD (1400 BP); undifferentiated Musaceae phytoliths were also present, sporadically, from about the late 3rd century AD (1770 BP).

Musa phytoliths were also identified in sediments from about the last two hundred years in Core M2C2. In addition, *Musa* remains were identified in a sediment sample with an extrapolated (calibrated) age of about the 16th century AD (350 BP), while *Musa*, *Ensete* and undifferentiated Musaceae phytoliths were discovered in sediment samples below plant macrofossils AMS ^{14}C-dated to AD 1019–1206 (940 ± 40 BP).

In Core M2C3C *Musa* phytoliths were again discovered in the uppermost sediments, here dating to within about the last 500 years (Fig. 2). The only other identified *Musa* phytoliths from this core are those that are the focus of this paper; these were recovered from sediments at the bottom of the core. These basal sediments, which also yielded *Ensete* phytoliths, underlie sediments with calibrated (at 2σ) AMS ^{14}C dates, in correct stratigraphic order, of 2136–1891 BC (3640 ± 40 BP) and 3492–3100

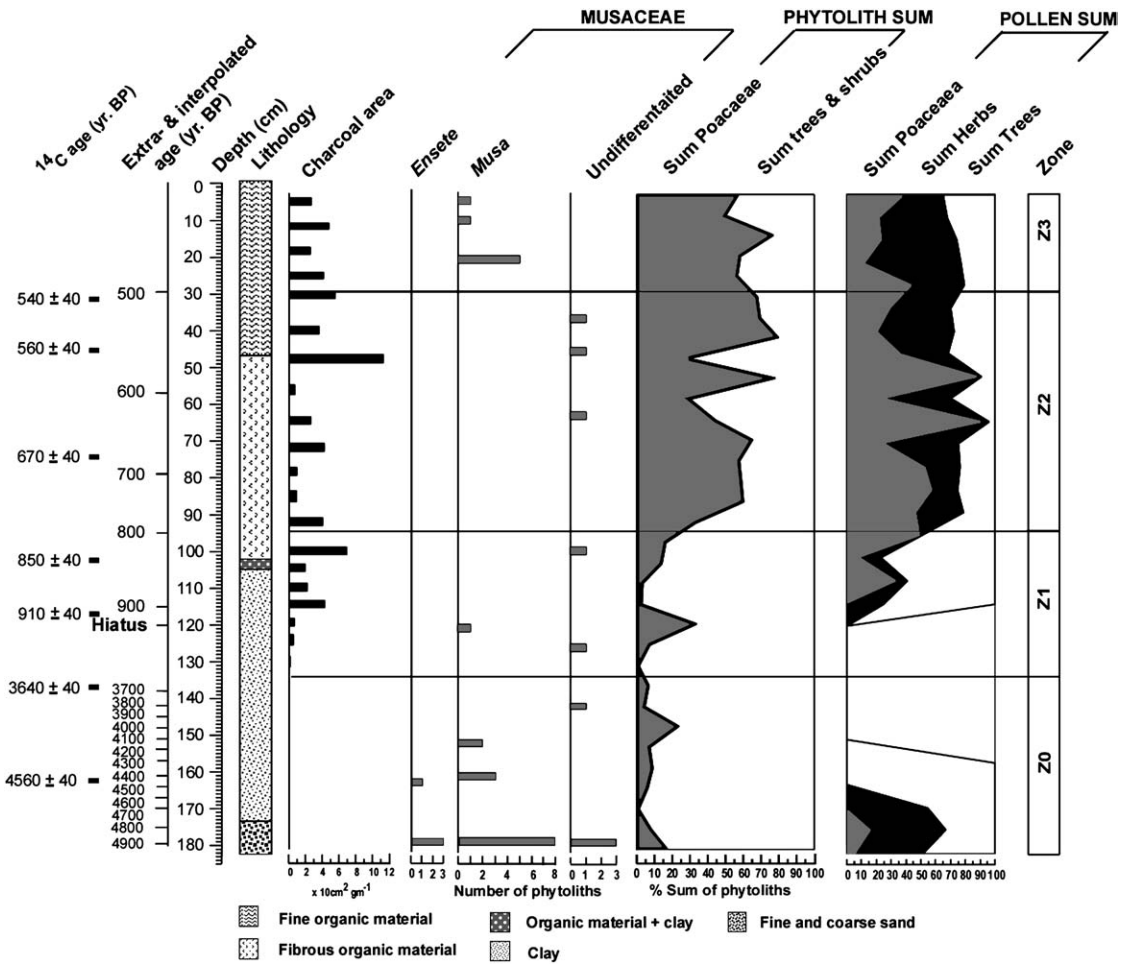


Fig. 2. Summary of down-core variations in abundances of charcoal, major categories of subfossil pollen taxa and phytoliths for core M2C3C. See Lejju et al. [27] for further information on the techniques used to acquire the data and on the data themselves.

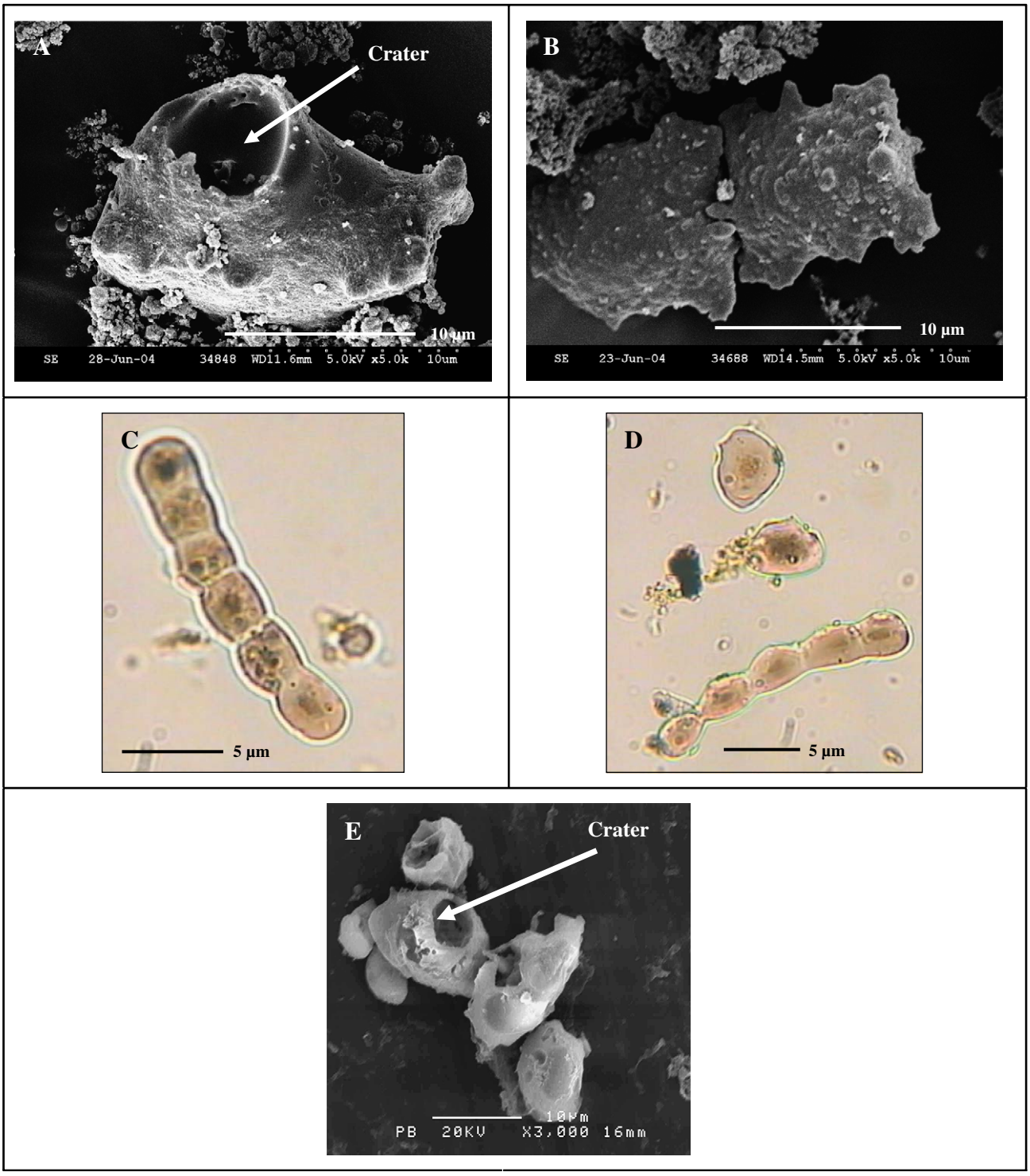
BC (4560 ± 40 BP). Significantly, the basal sample analysed from this core (i.e. from before cal 3492–3100 BC) yielded a total of 14 Musaceae-type phytoliths (e.g., Plates F, I and J). Of these, 8 were identified as *Musa*-type and 3 were identified as *Ensete*-type (see Plates E and F). Three could not be identified below the family level (i.e. they were classed as Musaceae Undifferentiated).

5. Discussion

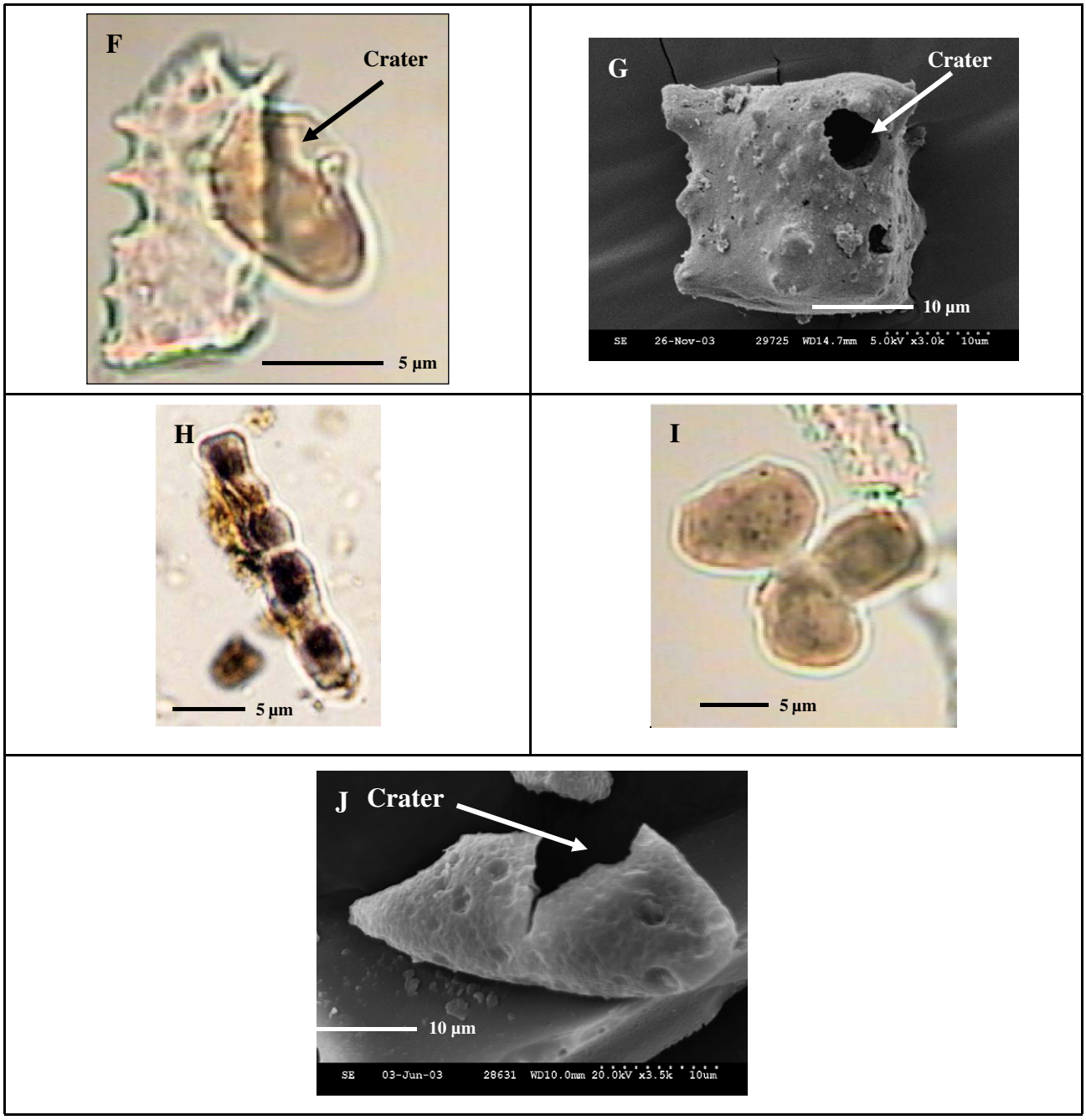
The presence of *Musa* phytoliths in sediments at Munsa dating within the last 1000 or 1500 years is not surprising, given accepted wisdom concerning both the timing of the arrival of this crop in central Africa [60] and the period of major development of banana farming [54,55]. What is very surprising, however, is the apparent presence of *Musa* in Core M2C3C in sediments dating to before the late fourth millennium BC.

5.1. The identification and taphonomy of Musaceae phytoliths from basal sediments in Core M2C3C

Morphological criteria for distinguishing Musaceae leaf phytoliths and for discriminating between *Musa* and *Ensete* are provided in Mbida et al. [31] and Vrydaghs and De Langhe [61] and are summarised in Table 2. Both *Musa* and *Ensete* produce chains of cone-shaped phytoliths that can fragment into individual bodies comprising a base and a raised cone with a crater, or trough, at the summit. In *Musa* the cone has concave slopes in equatorial view and a saddle-shaped crater with up to one indentation in its rim. Under SEM the surface of the cone appears verrucate (with wart-like sculpturing), although it appears smooth under an optical microscope, while the rim of the crater appears smooth to crenate (with rounded teeth). The form of the base in polar view may also provide a means of distinguishing *Musa*: the base usually supports obvious protuberances along all sides, and SEM reveals the base to have verrucate sculpturing. According to Carol Lentfer (pers. comm.),



Plates A–E. SEM and light micrographs of type phytolith morphotypes for Musaceae. **A**. SEM micrograph showing a slightly oblique polar view of *Musa paradisiaca* L. phytolith morphotype showing crater and projections. **B**. SEM micrograph of a polar view of *Musa paradisiaca* L. showing the rectangular shaped base with protuberances. **C. & D**. Light micrographs of chains of phytoliths from *Musa acuminata* Colla (type material). **E**. SEM micrograph of a polar view of *Ensete ventricosa* Maurelii showing the crater. The verrucate sculpturing of the wall is just visible.



Plates F–J. SEM and light micrographs of subfossil Musaceae phytoliths. **F**. light micrograph of *Musa* sp. in transverse view (M2C3C, 180–181 cm, c. 4900 BP). **G**. SEM micrograph of *Musa sp*. in polar view (M2C2, 137–138 cm, c. 960 BP) showing protuberances from the base. **H**. Light micrograph of Musaceae Undifferentiated chain phytolith in transverse view (M2C3C, 45–46 cm, c. 550 BP). **I**. Light micrograph of *Musa* sp. in transverse view (M2C3C, 180–181 cm, c. 4900 BP). **J**. SEM of *Ensete* sp. phytolith in transverse view, showing crater and verrucate sculpturing (M2C3C, 180–181 cm, c. 4900 BP).

there is some overlap in morphology of the base of phytoliths produced by Asian (New Guinean) *Musa* and *Ensete glaucum* (Roxb.) Cheesman. However, *Ensete glaucum* is not native to Africa, and phytoliths from African members of the *Ensete* genus seem to possess a base without protuberances, a cone with convex slopes in equatorial view and verrucate sculpturing visible under both optical and SE microscopes. Furthermore, the crater is flat (i.e. not saddle-shaped), without crenations but with two to three indentations. Although it seems possible to distinguish phytoliths produced on the leaves of *Musa* plants from those produced on the leaves of *Ensete*, there are no obvious intra-genus morphological differences (and see ref. [32]). In the present work, Musaceae

Table 2
Morphological criteria for separating Musaceae phytoliths into *Musa* and *Ensete* types

Morphological criteria	*Musa* type	*Ensete* type
Shape of individual cone	Concave	Convex
Sculpturing on surface of cone	Verrucate under SEM; smooth under optical microscope	Verrucate under both SE and optical microscopes
Shape of crater and form of crater rim	Saddle-shaped with up to one indentation in its smooth to crenate (rounded-toothed) rim	Flat, smooth crater with 2–3 indentations
Form of base	With protuberances	Without protuberances

See text and Plates A–J for further information.

phytoliths that could not be identified to either *Ensete* or *Musa*, usually because of damage, were categorized as "Musaceae Undifferentiated".

Once produced, phytoliths are resistant to oxidation and readily accumulate in many depositional environments, including swamps. Although the activities of burrowing animals and/or a fluctuating water table can conceivably move small palymorphs such as phytoliths vertically through a sediment profile, there seems no good reason why a sizable number of *Musa* phytoliths (as is the case with the basal sample from M2C3C) should be thus influenced, at least without the AMS ^{14}C dates, charcoal and sub-fossil pollen data being similarly affected. Furthermore, phytoliths currently accumulating at a site such as Munsa II, with its small catchment and limited fluvial input, are most likely to have been produced locally [43] because, unlike pollen, plants are not adapted for phytolith dispersal. The limited fluvial input to Munsa II also means that phytoliths accumulating at the swamp are likely to be primary in origin. This may not always have been the case, however, as the more inorganic deposits in the lowermost parts of the sequences from Munsa II indicate a much higher fluvial input in the past. Therefore it is possible that some of the phytoliths in the lowermost sediments from Munsa II, including the basal sample analysed from core M2C3C, are from eroded soils and are thus of secondary origin. Even so, a secondary origin for the *Musa* phytoliths in samples from the lower part of core M2C3C does not have a significant bearing on their interpretation, given the small size of the catchment and that they are unlikely to be younger than their apparent age based on the available AMS ^{14}C dates.

The inclusion of material of secondary origin in the more inorganic sediments from the lower part of core M2C3C might affect the accuracy of the two oldest AMS ^{14}C dates (3640 $\pm$ 40 BP and 4560 $\pm$ 40 BP), as both dates were obtained from organic material from bulk sediment samples. The question remains, however, whether the presence of *Musa* at Munsa during the 4th millennium BC is plausible in terms of what is known about the domestication and subsequent history of bananas.

5.2. The history of bananas

Recent research at Kuk has demonstrated that bananas were deliberately planted in the highlands of New Guinea by at least as early as 5000–4490 BC (6950–6440 cal BP) and that banana plants grew in this region in the earliest Holocene [11,12]. Moreover, recent genetic studies have confirmed that the wild *Eumusa* seeded banana, *Musa acuminata* ssp. *banksii* F.Muell., was domesticated in New Guinea and then dispersed to southeast Asia [25,26]. Thus, *M. acuminata* was the progenitor of the A genomes of domesticated bananas. However, the B genomes of domesticated bananas were derived from *Musa balbisiana* Colla, which occurs wild in parts of India, Sri Lanka, Burma, and southwest China [57]. Evidence of wild banana seeds from an early Holocene site in Sri Lanka [19] probably indicates exploitation of *M. balbisiana*. The first hybridization of A and B genomes probably occurred after AA cultivars were brought to south Asia from southeast Asia. The earliest archaeological evidence for such a domesticated A–B hybrid is probably that of the *Musa* phytoliths from the Harappan site of Kot Diji in Sindh, which dates to the second half of the third millennium BC [15,29]. The location and ecological setting of Kot Diji indicates that these must have been domesticated bananas, which are unlikely to have been AA or AAA cultivars.

From these beginnings a remarkable diversity of banana cultivars arose as a result of human intervention, since banana plants cannot propagate by natural means. This diversity is particularly well represented among the AAB plantains in the rainforest regions of Africa, with at least 115 known cultivars [51]. While this implies a long history of cultivation and experimentation within Africa [8] (but see ref. [60]), it is also likely that bananas may have been introduced to Africa several times. AA and AAA cultivars may have been introduced directly from southeast Asia, whereas AAB and ABB hybrids are more likely to have reached Africa from India or Sri Lanka. Thus, it is unfortunate that we cannot yet identify different banana genomes from their phytoliths.

It has been suggested that the first bananas to arrive in Africa were plantains brought to the east coast of Africa across the Indian Ocean by 1000 BC, prior, in other words, to the settlement of Madagascar by Austronesians [9,57]. Such early voyaging across the Indian Ocean has been tentatively credited to Proto-Malayo-Polynesian-speaking populations [8], who apparently may have possessed a considerable vocabulary pertaining to outrigger canoes at an appropriately early date [2]. In this scenario, rapid acceptance and development of plantain cultivation in east Africa may

have been facilitated by the indigenous inhabitants' familiarity with *Ensete*, which they may have already "semi-cultivated" [8,9] (but note the caution expressed by Philippson and Bahuchet [40]). Indeed, Rossel [51] has suggested that "the importance of the use of *Ensete* for technical purposes (fiber production) in eastern Africa, combined with the fact that *Musa* names are in many cases borrowed from *Ensete*, leads [one] to think that an early success of *Musa* depended more on its usefulness for non-food purposes (fibers, etc.)". From these auspicious beginnings, plantain cultivation and experimentation with the propagation of new cultivars may have spread rapidly across the tropical belt of Africa. It has also been suggested that the early arrival of plantains was merely the first of a series or waves of introductions of banana cultivars to the African continent [9]. The objection that bananas are not mentioned in the historical literature of the Middle East until the 6th century AD and that the plant itself has not been found at the major Red Sea port of Berenike [60] may be rendered irrelevant on the basis of both geography [32] and linguistic research that seems to indicate that the first bananas were introduced to Africa via the east African coast [51,52].

Given the evidence for early domestication of bananas in New Guinea by the early 5th millennium BC, it would seem to be within the bounds of possibility for bananas to have reached Uganda by the mid to late 4th millennium BC, particularly if these were AA or AAA cultivars brought directly from southeast Asia. This would imply arrival of the plant on the east African coast long before the date of about 1000 BC suggested as a *terminus ante quem* by De Langhe et al. [9]. However, such an early arrival would also seem to be contradicted by the linguistic evidence linking the dispersal of bananas across Africa with Bantu languages [51,52] whose antiquity is not usually deemed to extend back as early as the 4th millennium BC. Therefore, the next question that must be addressed is whether or not there is any evidence to support the idea of Indian Ocean voyaging at the required early date to permit bananas to have reached Uganda during the mid 4th millennium BC.

5.3. Indian Ocean prehistory

The banana is only one of several species of domestic plants and animals that were introduced to Africa across the Indian Ocean. Among the plants, these include coconut (*Cocos nucifera* L.), sugarcane (*Saccharum officinarum* L.), rice (*Oryza sativa* L.), colocasia or taro (*Colocasia esculenta* (L.) Schott), and water yams (*Dioscorea alata* L.). Indeed, sugarcane, like banana, probably originated in New Guinea [56] and may have reached India 4000 or more years ago [65]. Sugarcane and rice are mentioned in the first-century AD Periplus of the Erythraean Sea as imports to the Somali coast from India [4]. The first mention of all these crops in historical documents appears to indicate that they had arrived on the east African coast by the late first millennium AD [65]. However, Wigboldus's conservative view that they were first cultivated on the east African coast only at this late date [65] places far too much reliance on very sparse documentary sources.

Chickens (*Gallus gallus* L.) are another southeast Asian domesticate that have become ubiquitous in Africa. Until recently a major problem in dating the arrival of chickens in Africa was the difficulty of separating chickens from indigenous fowl on the basis of osteology. Thus, the archaeological evidence is sparse; the earliest skeletal evidence for this species in Africa, as well as the earliest literary reference, dates to the eighteenth dynasty in Egypt (*c*. 1567–1320 BC), but the first chicken bones south of the Sahara date only to the mid-1st millennium AD, at Jenne-jeno [28]. The Egyptian evidence, as well as the recent discovery of purported chicken bones in Machaga Cave on Zanzibar in deposits dated to the first millennium BC [5], would seem to support the banana-based evidence for southeast Asian contacts by at least as early as the 1st millennium BC. However, there remain unresolved issues, at least for some archaeologists, concerning the provenience and identification of these Zanzibari chicken bones [48].

Several crops of African origin occur in south Asia, initially associated directly or indirectly with the Harappan civilization. The first occurrence of pearl (bulrush) millet (*Pennisetum glaucum* (L.) R. Br.) falls within the Late Harappan period at about 2000 BC or a little earlier [14,63]. Sorghum (*Sorghum bicolor* (L.) Moench) was probably introduced at about the same time [14,63] (Fuller [14] convincingly refutes the arguments for late domestication of sorghum in Africa). This crop also reached Korea by 1400 BC [36]. However, a recent re-examination of the archaeobotanical evidence for finger millet (*Eleusine coracana* (L.) Gaertn.) in south Asia has shown that claims for the presence of this crop in the mid-3rd millennium BC were based on faulty identifications; the earliest secure dates for this crop in south Asia fall only towards the end of the 2nd millennium BC [14]. In addition to these cereals, cow peas (*Vigna unguiculata* (L.) Walp.), a domesticate of west or perhaps southern African origin, were definitely present in southern Asia by about 1500 BC and probably several centuries earlier [14], while hyacinth beans (*Lablab purpureus* (L.) Sweet), an east African domesticate, reached south Asia by at least as early as 1800 BC [14]. Thus, in summary, several plant species that were first domesticated in Africa had reached south Asia towards the beginning of the 2nd millennium BC and possibly by about the end of the 3rd millennium BC. Fuller [14] also notes that "[T]he general distribution of *Lablab*, *Eleusine*, and caudatum *Sorghums* might all argue for dispersal from coastal regions south of the

horn of Africa", while there is a dearth of evidence for these crops on the Arabian peninsula.

Evidence for African crops in south Asia by the beginning of the 2nd millennium BC does not itself constitute direct evidence for African-southeast Asian connections during this period. However, it does show that Indian Ocean voyaging, with one terminus probably on the east African coast, occurred by this date. Moreover, three cereal crops were introduced to south Asia from east Asia during the same general period (foxtail millet (*Setaria italica* (L.) Beauv.) by 2400 BC; broomcorn (*Panicum miliaceum* L.) and barnyard millet (*Enchinochloa colona* (L.) Link) by 1900 BC) [63], while the banana phytoliths from Kot Diji, discussed above, indicate that banana cultivars also arrived in south Asia by the third millennium BC. Finally, probable cloves, which are native to the Moluccas, have been discovered in a pot at the site of Terqa on the Euphrates River in a context dated *c*. 1700–1600 BC [44]. Thus, these data offer indirect support to the notion that bananas could have been brought to Africa during the 3rd millennium BC, if not before.

One piece of artifactual evidence also demonstrates that the east African coast was engaged in Asian trade during the 3rd millennium BC. Analysis of a pendant found at Tell Asmar, ancient Eshnunna, in Mesopotamia shows that is was made of copal from the "Zanzibar, Madagascar, Mozambique region of East Africa" [35].

Similarly intriguing is the ethnographic evidence for ancient connections between Africa and Indonesia. A careful review of this evidence indicates that not only is it likely that the xylophone was an African introduction to Indonesia, but also, and even more surprisingly, the canoes of Lake Victoria share some very detailed and otherwise globally unknown features with those of Java and Madura [1]. Of course, it is very difficult to discern the antiquity of these connections, though Blench [1] argues that the accuracy of the descriptions of the Lake Victoria region found in Ptolemy's geography indicates that "a regular trade route must have existed between the Lake and the coast, sufficiently well organized to allow the transmission of maritime technology".

In summary, our reading of the archaeological evidence from Indian Ocean prehistory indicates that bananas could well have been brought to the east African coast in the 3rd millennium BC. However, there is no evidence from the Indian Ocean to support the hypothesis of an introduction in the preceding millennium, apart from the evidence that bananas had been domesticated at an appropriately early date in New Guinea.

5.4. African prehistory

There does not appear to be any evidence for plant cultivation and domestication in tropical Africa by the mid 4th millennium BC that might provide an agricultural context for the early banana phytoliths at Munsa, though a paucity of research may well be the reason. A recent review of the evidence for early farming in Africa includes a map of sites with published archaeobotanical evidence relevant to African agricultural origins; this map shows no sites whatsoever between Nkang in Cameroon, the site with 1st millennium BC banana phytoliths [30,31], and sites in Zimbabwe [37]. Indeed, the Nkang banana phytoliths are the only archaeobotanical evidence for prehistoric agriculture in the African rain forest [37]. More generally the African archaeological evidence appears to indicate that, outside of Egypt, agriculture was a late phenomenon compared to other continents, "developing slightly before 1800 b.c. [c. 2200 BC] in the southwestern and south-central Sahara and much later, from the middle of the first millennium b.c. [mid-1st millennium BC] onwards, in other parts of the continent" [37]. But the southern Asian evidence, with its earlier dates for African crops, shows the fallacy of this conclusion.

Despite the absence of direct evidence for domestic crops in tropical Africa, settlement archaeology may provide some clues relevant to understanding the context of the early banana phytoliths at Munsa. Although there has been only limited archaeological research in the equatorial rain forest, surveys and excavations along the Zaire River have revealed that the inner Zaire basin was settled by people with ceramics and presumably practicing agriculture by the late first millennium BC [10,13,66]. Closer to Uganda, excavations at rockshelters in the Ituri Forest appear to indicate that this region was colonized by farmers only about 1000 years ago [34]. However, the oleaginous *Canarium schweinfurthii* Engl. was exploited in this region from the early Holocene, if not before [33], though this does not imply that the plant was domesticated. A recent review of Holocene archaeological data from western and central Africa encourages archaeologists to abandon the strict conceptual dichotomy between foragers and farmers and embrace a more nuanced approach viewed in terms of the concept of intensification [3]. From this perspective, intensification in the exploitation of plant resources in central Africa may well have begun long before the late first millennium BC, but the difficulty in discovering archaeological evidence for the exploitation in forested regions of both yams (*Dioscorea* spp.) and plantains (*Musa* spp.) has hampered research.

Turning away from central Africa and the rain forests, the Kansyore (Oltome) ceramic tradition of the Lake Victoria basin might offer a more suitable context for banana cultivation in the mid to late 4th millennium BC. Kansyore sites, often with high densities of ceramics and faunal remains, as well as stone artifacts, occur on the shores of Lake Victoria, in the form of shell middens, and at good fishing spots, generally rapids, on rivers draining into the lake

[7,20,38,45,46,50,62]. Dates for this tradition range from about the late 8th millennium BC (8200 BP) to about 500 BC (2400 BP) [21], though many of these dates are problematic [50]. Faunal remains mostly belong to wild species, including numerous fish, though a few domestic stock appear to be associated with this pottery at Gogo Falls [20]. With the exception of Gogo Falls [64], little effort has been made to recover plant remains from Kansyore sites. Thus, it is not surprising that no domestic plants have been found associated with this ceramic tradition, though a seed of the wild progenitor of domestic finger millet (*Eleusine coracana* subsp. *africana* (Kem.-O'Byrne) Hilu & de Wet) was recovered at Gogo Falls [23]. While the high densities of artifacts at Kansyore sites might suggest occupation by delayed-return hunter-gatherers [7], they might conceivably reflect sedentism anchored by the cultivation of bananas supplemented by fishing and broad-spectrum foraging.

This is, of course, rank speculation but the probable existence of Kansyore sites in the Lake Victoria basin contemporary with the early banana phytoliths at Munsa should make the search for phytoliths on and adjacent to Kansyore sites a high priority for future fieldwork. Ceramics identified as Kansyore have also been found in the Nguru Hills, which enjoy heavy rainfall and are located less than 150 km inland from the Tanzanian coast opposite Zanzibar [59], while claims have also been made that "Neolithic" pottery found on the coast, hinterland and islands of Tanzania may indicate the existence of agriculture by 3000 BC [6]. Thus, the potential may exist here for a cultural context that could have facilitated the diffusion of bananas, as well perhaps as canoe technology [1], from the east African coast to the Great Lakes region.

6. Conclusion

Cultivation of *Musa* at Munsa could have commenced at an early date, although there is no archaeological or linguistic evidence to support a date as early as the 4th millennium BC. The Kansyore (Oltome) ceramic tradition of the Lake Victoria basin may provide the necessary cultural context for this early cultivation, while the uptake and spread of banana cultivation may have been facilitated by a familiarity with indigenous varieties of *Ensete*. It is possible, however, that the two oldest AMS ^{14}C dates so far obtained for Munsa sediments are erroneous, and therefore that the Musaceae phytoliths at the base of M2C32 are younger than indicated. An alternative explanation is that the morphological criteria used to discriminate between *Musa* and *Ensete*, and even to distinguish Musaceae, are not sufficiently resolved, a point recently raised by Vansina [60] in reference to the phytolith-based evidence for early banana cultivation in southern Cameroon. Clearly final confirmation of the results presented here will require improved knowledge of the variability of Musaceae phytolith morphotypes, as well as improved chronological control for the early part of the sedimentary record at Munsa.

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