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NEW EVIDENCE OF HUMAN ACTIVITIES DURING THE HOLOCENE IN THE LOWLAND FORESTS OF THE NORTHERN CONGO BASIN

Julie Morin-Rivat[1,2,3] • Adeline Fayolle[1] • Jean-François Gillet[1] • Nils Bourland[1,2] • Sylvie Gourlet-Fleury[4] • Richard Oslisly[5] • Laurent Bremond[6] • Ilham Bentaleb[7] • Hans Beeckman[2] • Jean-Louis Doucet[1]

ABSTRACT. In the last decade, the myth of the pristine tropical forest has been seriously challenged. In central Africa, there is a growing body of evidence for past human settlements along the Atlantic forests, but very little information is available about human activities further inland. Therefore, this study aimed at determining the temporal and spatial patterns of human activities in an archaeologically unexplored area of 110,000 km^2 located in the northern Congo Basin and currently covered by dense forest. Fieldwork involving archaeology as well as archaeobotany was undertaken in 36 sites located in southeastern Cameroon and in the northern Republic of Congo. Evidence of past human activities through either artifacts or charred botanical remains was observed in all excavated test pits across the study area. The set of 43 radiocarbon dates extending from 15,000 BP to the present time showed a bimodal distribution in the Late Holocene, which was interpreted as two phases of human expansion with an intermediate phase of depopulation. The 2300–1300 BP phase is correlated with the migrations of supposed farming populations from northwestern Cameroon. Between 1300 and 670 BP, less material could be dated. This is in agreement with the population collapse already reported for central Africa. Following this, the 670–20 BP phase corresponds to a new period of human expansion known as the Late Iron Age. These results bring new and extensive evidence of human activities in the northern Congo Basin and support the established chronology for human history in central Africa.

INTRODUCTION

In the last decade, the myth of the pristine tropical forest has been seriously challenged (van Gemerden et al. 2003). As these areas are currently covered by dense forest, they were formerly regarded as intact (Willis et al. 2004). Multiple lines of evidence of ancient human activities have been recorded, however, across the tropics and these have likely influenced tropical forest structure and composition (Barton et al. 2012). Indeed, recent research has attested to early agriculture and land management dated to several thousand years ago in currently sparsely populated or depopulated areas (Barker et al. 2007; Summerhayes et al. 2010; Arroyo-Kalin 2012; Barton 2012; Barton et al. 2012; Haberle et al. 2012; Hunt and Prematilake 2012; Kennedy 2012; Kingwell-Banham and Fuller 2012; McNeil 2012; Rostain 2012; Sémah and Sémah 2012; Stahl and Pearsall 2012; Torrence 2012). In central Africa, artifacts (e.g. stone tools, potsherds, and iron slags) and charred botanical remains (e.g. charcoals and endocarps) constitute valuable witnesses of human history in the forests (van Gemerden et al. 2003; Wotzka 2006; Brncic et al. 2007; Höhn and Neumann 2012; Logan and D'Andrea 2012; Neumann et al. 2012a; Gillet and Doucet 2013; Oslisly et al. 2013a).

In tropical Africa, the current forest composition, specifically the dominance of long-lived light-demanding species in the canopy, have been mostly interpreted as the result of recent human activities (Aubréville 1947; Letouzey 1968; White and Oates 1999; Brncic et al. 2007; Greve et al. 2011). Recently, Bayon et al. (2012) even asserted that human land-use intensification was the determining factor in the major vegetation change that occurred about 3000 yr ago, when rainforests were abruptly replaced by a forest-savanna mosaic in the course of a few centuries. However, such large-scale human-driven vegetation changes have largely been questioned. Paleoecologists and archaeologists indeed agree on the fact that this "rainforest crisis" was related to a large climate

1. Unité de Gestion des Ressources Forestières et des Milieux Naturels, Laboratoire de Foresterie des Régions Tropicales et Subtropicales, Université de Liège, Gembloux Agro-Bio Tech, Gembloux, Belgium.
2. Service of Wood Biology, Royal Museum for Central Africa, Tervuren, Belgium.
3. Corresponding author. Email: jmorin@ulg.ac.be.
4. UPR BSEF, CIRAD, Campus International de Baillarguet, F-34398 Montpellier, France.
5. IRD, UMR 208-IRD/MNHN, Patrimoines locaux, Agence Nationale des Parcs Nationaux, Libreville, Gabon.
6. CBAE, Centre de Bioarchéologie et d'Écologie, UMR 5059-CNRS-EPHE-INRAP-UM2, Montpellier, France.
7. ISEM, Institut des Sciences de l'Évolution, UMR 5554-CNRS, Université Montpellier II, Montpellier, France.

change that led to a drier and more seasonal rainfall regime rather than due to human disturbance (Neumann et al. 2012b).

Patterns of human activities in central Africa have rarely been documented to date (Clist 1990; Wotzka 2006). Only a few Late Stone Age sites have been discovered for the Early and Middle Holocene (12,000–2500 BP) in all of central Africa (Cornelissen 2002). By contrast, archaeological studies have shown an increase in the number of sites with evidence of human occupation from the dry event of 2500 BP (Wotzka 2006; Oslisly et al. 2013b). From this time, the landscape opening allowed the expansion of human populations from the Cameroon-Nigeria border southwards to Gabon, Cameroon, the Republic of the Congo, and the Democratic Republic of Congo (Schwartz 1992; Lanfranchi et al. 1998; Clist 2006). These populations are considered "Bantu-speakers," who produced pottery (Neolithic, around 3500–2000 BP), and somewhat later forged iron (Early and Late Iron Age, around 2800–1800 and 1000–200 BP, respectively) (Manima-Moubouha 1987; Oslisly and Peyrot 1992; Lanfranchi et al. 1998; Wirrmann and Elouga 1998; Assoko Ndong 2002; Holden 2002; Diamond and Bellwood 2003; Phillipson 2003; Lavachery et al. 2005; Clist 2006; Eggert et al. 2006; Oslisly 2006; Meister 2007, 2010; Meister and Eggert 2008). The Bantu question is often contradictory, however, and their economy has rarely been documented (Neumann 2005). The practice of slash-and-burn agriculture has only been attested to at a few sites (Neumann et al. 2012a). Cattle raising was also impossible in dense forest due to the tsetse disease (Gifford-Gonzalez 2000). Nevertheless, iron tools seem to have allowed the populations to penetrate deeply into the forest across the whole Congo Basin (Schwartz 1992; Oslisly and Peyrot 1992; Eggert 1993). Under these conditions, populations are expected to have settled inland, but the largest sets of occupations appear to be restricted to zones where water is available: the Atlantic Ocean and the freshwater sources located further east, i.e. to the Congo River and the African Great Lakes. As few large sites have been excavated, however, our understanding of the extent of the Iron Age settlements remains limited (Lanfranchi et al. 1998).

Regarding the spatial distribution of archaeological excavations in central Africa (Clist 2006; Wotzka 2006), there is a growing body of evidence for past human presence in the Atlantic forests of Gabon and in SW Cameroon, but very little information is available further inland. This seems to be an artifact of documentation, probably due to a lack of archaeological surveys in dense forest compared to more accessible environments. We postulated that the "rainforest crisis" of 2500 BP, by creating a more open landscape, may have fostered the settlement of populations even in areas that are covered by dense forest today. This study thus aims at finding new evidence of human activities in the lowland forest of the northern Congo Basin, in archaeologically unexplored areas. The following questions are specifically addressed. Were human settlements encountered in the study area? If so, since when were human populations present, and how were their activities distributed over time?

MATERIALS AND METHODS

Study Area

The study area covers southeastern Cameroon (Eastern Region) and the northern part of the Republic of the Congo (Sangha and Likwala departments) (Figure 1). The investigated areas represent 30,000 km^2 in Cameroon and 80,000 km^2 in the Republic of the Congo, between 3°65′N and 0°50′N (northern and southern, 350 km apart) and 13°50′E and 16°70′E (western and eastern, 550 km apart). A total of 36 study sites were sampled across the study area. The 11 sites in Cameroon are located between the Boumba and Dja/Ngoko rivers. The 25 sites in the Republic of the Congo are located between the Lobaye River, Mambili River, and the Likwala-aux-Herbes swamps/Ubangui River. The climate is humid tropical with a 3-month dry season (December-February). Mean annual rainfall ranges between 1430 mm (Batouri, Cameroon), 1685 mm

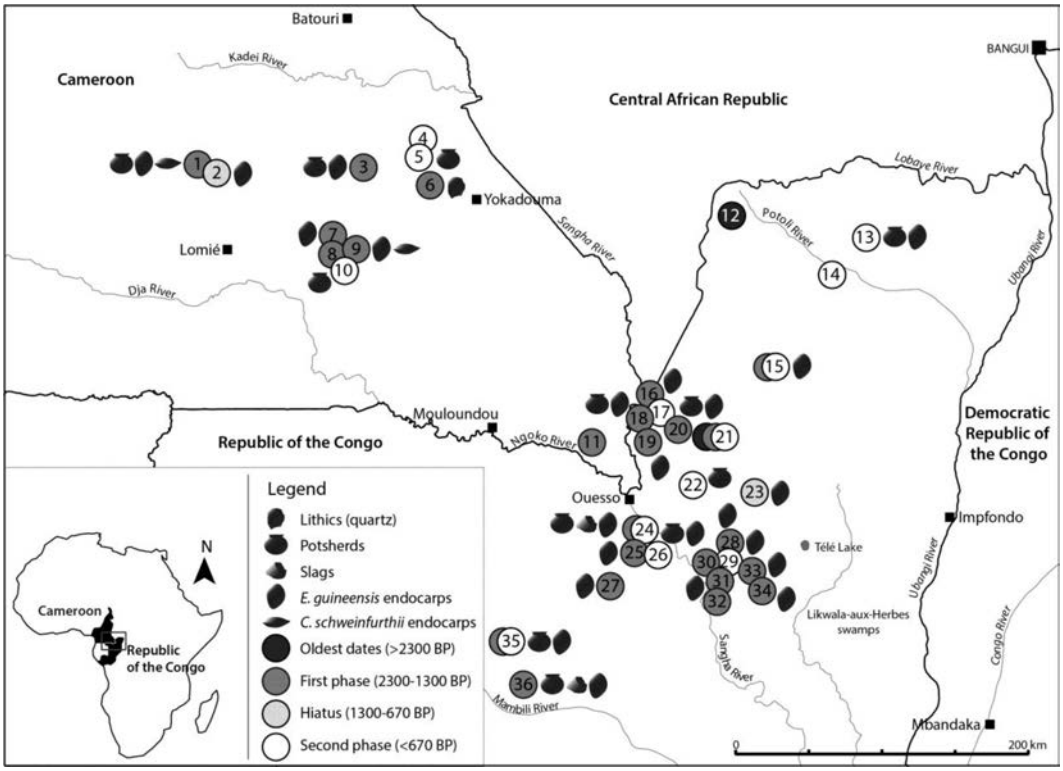

Figure 1 Location of the sites; the four phases as well as the archaeological and archaeobotanical findings are reported

(Ouesso, Congo), and 1735 mm (Lomié, Cameroon). Monthly average temperatures fluctuate around 25° (Global Water Partnership 2009). The vegetation consists of semi-deciduous moist forest of the Guineo-Congolian domain, which is dominated by large emergent light-demanding trees (White 1983; Gillet and Doucet 2012). The prospected forests lay on weathered bedrock from the Precambrian schistoquartzitic complex in Cameroon (Vennetier 1963) and on Mesozoic sandstones and Quaternary alluvial deposits in the Republic of the Congo (Schwartz and Lanfranchi 1993). The relief is broadly flat across the study sites, but with decreasing altitude from the west to the east, between 600–700 and 350–460 m, in Cameroon and Republic of the Congo, respectively.

Sampling Protocol and Radiocarbon Dating

Fieldwork was carried out in 6 fieldwork campaigns between 2008 and 2011. Study sites were selected along transects laid out along a vegetation gradient from *Gilbertiodendron dewevrei* monodominant forests to open-canopy Marantaceae forests, over stands dominated by deciduous light-demanding tree species. A 1.3 × 1 × 2 m test pit was opened in each of the 36 study sites. The presence of artifacts (i.e. human-made objects) and charred botanical remains (either charcoal or charred endocarps) was examined across the whole soil profile in 10-cm layers. Charred material was dated (a) that was associated with human settlement (e.g. next to potsherds) and/or (b) that allowed taxonomic identification (endocarps, charcoals); (c) that ensured accurate dating, wherever possible short-lived material (e.g. charred endocarps); and (d) that was derived from the uppermost "charcoal layer" (latest fire event). All dates were obtained from fragments between 2 and 4 mm in diameter for charcoals, up to 8 mm in diameter for endocarps. In total, 43 accelerator mass spectrometry (AMS) dates were obtained by the Poznań Radiocarbon Laboratory (Poz) and the

Table 1 Raw dates in years BP with calibrations. Dates are ranked from the oldest to the most recent and classified into four groups: oldest dates (>2300 BP), first phase of human expansion (between 2300 and 1300 BP), intermediate hiatus phase (between 1300 and 670 BP), and second phase of human expansion (<670 BP). Country: C = Cameroon; RC = Republic of the Congo. "Map nr" refers to the number indicated in Figure 1. Dated material (DM): C = charcoal; CE = charred endocarp. Identified taxa: *E. g.* = *Elaeis guineensis*; *C. s.* = *Canarium schweinfurthii*; *G. d.* = *Gilbertiodendron dewevrei*; *N.* sp. = *Nauclea* sp. Artifacts: Lith. = Lithics; Pot. = Pottery; Iron. = Iron slags.

									Calibration		Artifacts			Charred botanical material		
Country	Site	Map nr	Depth (cm)	DM	Id. taxa	Lab nr	BP	±	68.2%	95.4%	Lith.	Pot.	Iron	C	*E. g.*	*C. s.*
Oldest dates (>2300 BP)																
RC	Mokobo	21	120	C	.	KIA-38067	12,620	55	15,115/14,678	15,218/14,274	.	.	.	x	.	.
RC	Potoli River	12	145	C	.	Poz-41789	4610	35	5446/5301	5466/5086	.	.	.	x	.	.
First phase of human expansion (2300–1300 BP)																
C	Ndama	3	70	C	.	Poz-38701	2260	30	233/2183	2345/2157	.	x	.	x	.	.
RC	Ikelemba 1	30	40	C	.	KIA-34143	2170	30	2301/2124	2311/2065	.	.	.	x	.	.
C	Messok 1	8	10	C	.	KIA-38938	2150	45	2301/2060	2309/2003	.	.	.	x	.	.
RC	Landjoué	35	60	CE	*E. g.*	Poz-41782	2130	30	2152/2056	2299/2001	.	x	.	x	x	.
RC	Ilamba 2	34	50	CE	*E. g.*	KIA-34144	2095	30	2115/2008	2145/1994	.	.	.	x	x	.
RC	Pikounda 1	25	50	CE	*E. g.*	Poz-41771	2090	30	2113/2004	2145/1991	.	.	.	x	x	.
C	Messok 2	9	50	CE	*C. s.*	KIA-45499	1980	25	1969/1890	1990/1880	.	.	.	x	x	x
C	Mbol	6	35	C	.	Poz-41773	1870	30	1868/1740	1877/1724	x	.	.	x	.	.
RC	Ikelemba 3	32	30	C	.	KIA-34147	1830	35	1816/1728	1867/1638	.	.	.	x	.	.
RC	Kabo	19	30	CE	.	KIA-37687	1800	30	1811/1699	1821/1626	.	.	.	x	x	.
C	Makalaya	7	50	CE	*E. g.*	KIA-38933	1795	40	1812/1635	1857/1607	.	.	.	x	x	.
RC	Ngombé	24	35	CE	*E. g.*	Poz-38702	1765	30	1718/1619	1811/1571	.	x	.	x	x	.
RC	Loundoungou	15	60	C	.	Poz-41788	1760	40	1721/1610	1812/1565	.	.	.	x	.	.
RC	Bomassa 2	18	35	CE	*E. g.*	KIA-39606	1715	25	1691/1568	1697/1555	.	x	.	x	x	.
RC	Ndoki River	20	45	CE	*E. g.*	KIA-39607	1715	25	1691/1568	1697/1555	.	x	.	x	x	.
C	Ndama	3	50	CE	*E. g.*	Poz-41790	1640	30	1598/1445	1614/1416	.	.	.	x	x	.
C	Mindourou 1	1	45	CE	*E. g.*	KIA-45497	1630	25	1561/1423	1601/1416	.	x	.	x	x	x
RC	Baï Bomassa	16	0	CE	*E. g.*	KIA-38066	1625	25	1556/1422	1567/1415	.	.	.	x	x	.

(*Continued*)

Table 1 (*Continued*)

RC	Ikelemba 2	31	50	CE	*E. g.*	KIA-37684	1590	25	1524/1418	1534/1411	.	.	.	x	x	.
RC	Mambili River	36	65	C	.	Poz-38700	1590	30	1524/1417	1540/1407	.	x	x	x	x	.
RC	Liouesso	27	40	CE	*E. g.*	Poz-41770	1580	30	1518/1417	1535/1403	.	.	.	x	x	.
RC	Pokola 1	28	55	CE	*E. g.*	KIA-34141	1565	30	1516/1411	1528/1389	.	.	.	x	x	.
RC	Mokobo	21	75	C	.	KIA-38070	1535	25	1510/1381	1518/1356	.	.	.	x	.	.
RC	Ilamba 1	33	40	CE	*E. g.*	KIA-37686	1515	30	1415/1349	1518/1334	.	.	.	x	x	.
C	Boulou River	11	40	C	*G. d.*	Poz-41778	1510	30	1412/1351	1515/1327	.	.	.	x	.	.
Intermediate hiatus phase (1300–670 BP)																
RC	Komo River	23	40	CE	*E. g.*	Poz-41780	1200	30	1171/1077	1239/1013	.	.	.	x	x	.
C	Mindourou 2	2	35	CE	*E. g.*	KIA-45496	1050	25	968/932	1052/925	.	.	.	x	x	.
Second phase of human expansion (<670 BP)																
RC	Ngombé	24	35	C	.	Poz-38703	675	30	671/567	679/560	.	x	x	x	.	.
RC	Pokola 2	29	35	CE	*E. g.*	KIA-34142	620	25	652/558	658/551	.	.	.	x	x	.
C	Bali River 2	5	30	C	.	Poz-41775	590	30	637/547	652/537	.	x	.	x	.	.
RC	Pikounda 2	26	20	CE	*E. g.*	Poz-41772	520	30	546/516	626/507	.	x	.	x	x	.
RC	Djaka River	22	40	C	.	Poz-38696	335	35	460/317	482/308	.	x	.	x	.	.
RC	Ebaleki River	13	20	C	.	Poz-38697	315	30	430/309	467/302	.	x	.	x	x	.
RC	Landjoué	35	35	CE	*E. g.*	Poz-41781	290	30	429/299	458/288	.	x	.	x	x	.
RC	Mokobo	21	30	CE	*N.* sp.	KIA-37685	215	25	300/–2	305/–4	.	.	.	x	.	.
C	Messok 3	10	10	C	.	KIA-38934	205	30	296/–2	305/–4	.	x	.	x	.	.
RC	Bomassa 1	17	20	C	.	KIA-37683	200	25	290/–2	299/–4	.	.	.	x	.	.
C	Messok 3	10	210	C	.	KIA-38942	195	30	288/–2	303/–4	.	.	.	x	.	.
RC	Lopola	14	30	C	.	Poz-41784	140	25	270/12	281/6	.	.	.	x	.	.
C	Bali River 1	4	10	C	.	Poz-41774	110	25	257/33	268/16	.	.	.	x	.	.
RC	Loundoungou	15	20	CE	*E. g.*	Poz-41787	90	30	254/33	266/22	.	.	.	x	x	.
Total occurrences											1	14	2	43	24	2

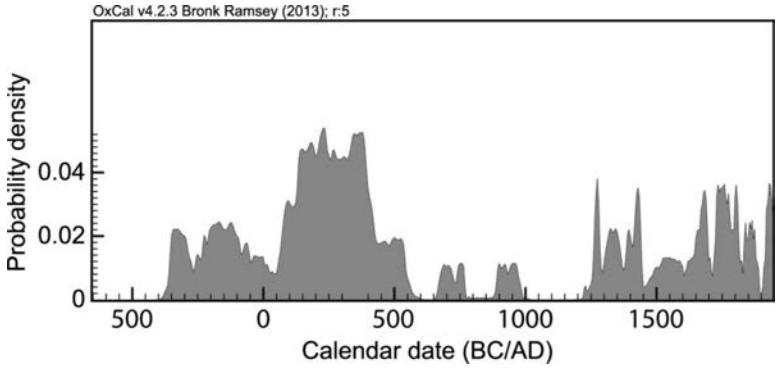

Figure 2 Summed probability distribution of the dates calibrated in BC/AD, $n = 41$ dates (two oldest dates are excluded: KIA-38067 and Poz-41789). Note that dates are concentrated in two time periods, centered on 2300–1300 BP (350 BC–AD 650) and after 670 BP (after AD 1280).

Leibniz-Laboratory for Radiometric Dating and Isotope Research of the University of Kiel (KIA). Calibration was performed using the OxCal v 4.2.3 program (Bronk Ramsey 1995, 2001, 2013) with the IntCal13 atmospheric calibration curve (Reimer et al. 2013) (Table 1). Also, using the OxCal program, a summed probability distribution of the dates calibrated in BC/AD was perforemed so as to compare with Wotzka's group dispersion calibrations for central Africa (Wotzka 2006).

RESULTS

Radiocarbon Dates

A set of 43 ^{14}C dates was analyzed extending from 15,000 BP to the present time (Table 1). The dates were not evenly distributed across the time period, with most dates belonging to the Late Holocene. When focusing on this most recent period (<2500 BP), a bimodal distribution was observed, documenting two phases of human expansion with a contraction phase in between (Figures 1 and 2, Table 1). The first phase of human expansion spans between 2300–1300 BP (350 BC–AD 650; 25 dates, 58%), while the second phase spans between 670–20 BP (AD 1280 AD to present; 14 dates, 33%; Figure 2). Only four dates deviate from this bimodal distribution (9%). The two oldest dates (12,620 ± 55 and 4610 ± 35 BP, KIA-38067 and Poz-41789, respectively, Table 1) correspond to charcoal samples, not identified yet, that may have been produced by natural fires in the absence of any other evidence of human activities. Two other dates (1200 ± 30 and 1050 ± 25 BP, Poz-41780 and KIA-45496, respectively) correspond to oil palm endocarps that may indicate sites of interest for the remaining human populations during the contraction phase.

Archaeological and Archaeobotanical Findings

Evidence of human activities, either artifacts or charred botanical remains (e.g. edible fruit), were found across the whole study area (Figure 1). Artifacts were found in 13 test pits (36% of the sites) with dates spanning between 2260 ± 30 BP (Poz-38701) and 205 ± 30 BP (KIA-38934) (Table 1). Among them, lithics (quartz flakes) were found in only small quantities in one test pit at the Mbol site while potsherds were frequently observed across the study area (12 test pits, 33%, Table 1). The potsherds (dated through charcoals) correspond to the two expansion phases described above: from 2260 ± 30 BP (Poz-38701) to 1590 ± 30 BP (Poz-38700) and from 675 ± 30 BP (Poz-38703) to 205 ± 30 BP (KIA-38934). Some of them, from both phases, showed a *roulette* decoration. In two sites in the Republic of the Congo, Mambili River and Ngombé, iron slags dating from 1590 ± 30 BP (Poz-38700) and 675 ± 30 BP (Poz-38703), respectively, were associated with potsherds.

Charred botanical remains were extracted from all test pits at different depths. Charcoals were the most numerous and could be found in all sites (Table 1). Several charcoal layers could occur in the same test pit, suggesting that the current dense forests had undergone repeated fire events during the Holocene. A total of 23 test pits provided charred endocarps, mostly oil palm endocarps (*E. guineensis* Jacq., 64%), with dates covering the whole chronology from 2130 ± 30 BP (Poz-41782) to 90 ± 30 BP (Poz-41787). Endocarps of *Canarium schweinfurthii* Engl. were found in two test pits in Cameroon (Mindourou 1 and Messok 2), in association with potsherds in the latter pit. These endocarps were dated from the first phase of human expansion (Figure 1), at 1980 ± 25 BP (KIA-45499) and 1630 ± 25 BP (KIA-45497), respectively.

DISCUSSION

Temporal and Spatial Patterns of Human Activities

The aim of this study was to identify the temporal and spatial patterns of human activities in archaeologically unexplored areas of the northern Congo Basin that are currently covered by dense forest. To document this aspect, archaeological and archaeobotanical evidence was found across the whole study area. Two phases of human expansion were noted during the Late Holocene (2300–1300 BP and after 670 BP), with a contraction phase in between in which there is almost no evidence of human settlement (1300–670 BP). The dates from both phases were evenly distributed and thus demonstrated a similar spatial pattern in the history of human activities, though the most distant sites were located several hundred kilometers apart.

The archaeological evidence showed human presence in the forest block from 2300 BP, confirming the hypothesis of a first occupation of magnitude in the northern Congo Basin with visible traces of human settlements (Wotzka 2006; Brncic et al. 2007). This first population peak between 2300–1300 BP followed the major forest fragmentation after the 2500 BP climatic dry event (Maley 2002; Ngomanda et al. 2005), whereas the second population peak (670–20 BP) may be related to moderate climatic fluctuations in central Africa (Maley 2003) corresponding to the Little Ice Age in Europe (Brncic et al. 2007; Russell and Johnson 2007). The results presented here confirm and extend Wotzka's (2006) observations describing the same temporal pattern for central Africa. This two-peak curve structure seems indeed to be specific to the part of central and west-central Africa currently covered by dense forests. The differences seen in the amplitude of the two peaks may thus be explained by differences in the tempo of the wave of human expansion from east to west equatorial Africa after about 2500 BP and of the decline of human settlement from west to east that occurred during the last millennium (Wotzka 2006).

However, an uncertainty persists in interpreting the scarcity of dates between 1300 and 670 BP. Following the successful colonization of the Congo Basin by "Bantu-speakers" from 2500 BP, several authors evoked a hiatus between 1400 and 800 BP (Oslisly 1998, 2001; Assoko Ndong 2002; Wotzka 2006). This hiatus has been interpreted as a population collapse that was caused by a wet climatic event (Schwartz 1992; Oslisly 2001; Assoko Ndong 2002). Oslisly (2001) postulated that a widespread epidemic disease could be at the origin of this hiatus. Such a hypothesis is still debated (Clist, reported by Wotzka 2006), although historical sources related major outbreaks of trypanosomiasis at the end of the 19th century (Sautter 1966; Oslisly et al. 2013a). Wotzka (2006) added that a lack of any human evidence may reflect differential destructive taphonomic processes, i.e. in this study a potential destruction of the archaeological remains during the Late Holocene due to the combination of a wetter period and of the acidity of equatorial soils (Eggert 1993; Schwartz and Lanfranchi 1993; Mbida et al. 2000). Given that the exact reasons of this large-scale event remain unclear, as well as its geographical extent, further results are needed to confirm any of these hypotheses.

Cultural Evidence for Human Presence within the Forest

Among the artifacts, potsherds were extremely frequent, with the oldest dating to 2260 ± 30 BP. Some from the 2300–1300 BP phase, as well as the 670–20 BP phase, showed a so-called *roulette* decoration, a decorative technique that was invented ~4000 yr ago in west Africa. In this technique, a cylindrical object (carved or knotted) is rolled on the unbaked clay pots (Livingstone Smith 2007). This *roulette* technique has been attested to in northwestern Cameroon around 2500–2000 BP during the Early Iron Age and persisted throughout the Late Iron Age (Livingstone Smith 2007). Despite its spread in a wide area from Senegal to the African Great Lakes, its dissemination into the central African forest block was very limited. Livingstone Smith (2007) reported a probable cultural boundary between farming and non-farming populations, which could be placed at the river Lom, northwest of Batouri (southeastern Cameroon). Our findings push this limit southwards and indicate that at ~2200 BP the forest dwellers either knew the *roulette* decoration technique or had contact with populations that used it. The study area may be a contact zone between different cultures, which again raises the question of the connections between foragers and food producers (Bahuchet 1996; Clist 2006; de Luna 2012). Although the *roulette* decoration has been identified on potsherds, no precise typotechnological analysis based on shape and decoration has been carried out thus far.

The iron slags associated with potsherds at two sites in the northern Republic of Congo demonstrate the presence of iron-smelting activities in sedentary settlements. The oldest site (Mambili River) dated to 1590 ± 30 BP (Poz-38700) represents the latest activity recorded for the Early Iron Age in the present study, whereas the other (Ngombé) occurs at the beginning of the Late Iron Age period (675 ± 30 BP, Poz-38703). Early Iron Age iron-smelting features dated to 2020–1800 BP have been excavated at the Likwala-aux-Herbes River site in Congo (Eggert 1993), which is located near our discoveries. New archaeological surveys may allow outlining the framework of the Iron Age occupations.

Flakes of quartz were only discovered in one site (Mbol) dated to 1870 ± 30 BP (Poz-41773). In the Cameroonian forest, the Neolithic is attested to by such an expedient lithic industry associated with stone axes and hoes from 3000 BP. Lithics disappeared with the introduction of iron tools around 2500 BP from the Central African Republic (Clist 2006). Our late date may indicate a recent use of stone flake industries in the forest by populations of foragers or an opportunistic use by food producers. Nonetheless, as the quartz tools suggest neglected industries, efforts shall be made to understand their implications in forest people's lifestyles.

Economic Behaviors

In addition to artifacts, plant remnants were used to demonstrate human activity. Charred botanical remains were discovered in all sites, especially charcoal. Several charcoal layers could be located in a same test pit, confirming the existence of repeated past fire events in the study area. Visible charcoal layers, in the absence of confirmed archaeological sites, may indicate the presence of ancient fields created by slash-and-burn agriculture (van Gemerden et al. 2003) or natural fires in periods of seasonal droughts (Hubau et al. 2013) though the latter seldom occur in the region (Maley 2002).

Our results mainly highlighted the recurrence of charred endocarps indicative of the economic behaviors of past populations (Neumann et al. 2012a). The most abundant were the endocarps of the oil palm *E. guineensis*, which appeared to be younger than 2200 BP in many of the study sites. Oil palm endocarps are frequently observed in archaeological sites in west and central Africa (Lavachery 2001; Lavachery et al. 2005; Logan and D'Andrea 2012). In palynological records, the increasing abundance of palm trees during the Late Holocene has led to controversial interpretations

about its anthropogenic (Sowunmi 1999) versus natural origin, fostered by forest fragmentation after 2500 BP (Maley and Chepstow-Lusty 2001). The antiquity of the use of products from oil palms and wild trees before agriculture has been well documented by linguistic and archaeobotanical studies (Bostoen 2005; D'Andrea et al. 2006; Blench 2007; Kahlheber and Neumann 2007). Current knowledge, however, is not decisive in favor of ancient tree management with the preservation of useful trees and oil palms during the forest clearing, as proposed by several authors (Lavachery 2001; Mercader et al. 2006; D'Andrea et al. 2006; Oslisly and White 2007).

In this study, endocarps of *C. schweinfurthii* dated between 1980 ± 25 and 1630 ± 25 BP (KIA-45499 and KIA-45497) were found in two test pits in Cameroon. This result is consistent with previous findings in Early Iron Age sites (Oslisly et al. 2000; Neumann et al. 2012a). Indeed, the fatty components of *C. schweinfurthii* make this species attractive for populations that can use it for several purposes including cooking (Abayeh et al. 1999). An ancient use of *C. schweinfurthii* was attested to about 11,000 BP in DRC (Mercader et al. 2003) and to 8000 BP in northwestern Cameroon (Lavachery 2001). *C. schweinfurthii* endocarps have been found later, too, in Neolithic sites in Gabon. Hence, it could be hypothesized that this wild species was used from late Prehistory by more sedentary human populations at the premises of arboriculture (Clist 2006). Nonetheless, as only few endocarps were found in the study area, no firm conclusions can be made as to whether this species was used extensively. Various charred seeds were also found in the test pits and further identification work is needed to study the economy of past forest populations.

CONCLUSION

This study gathered new and extensive evidence of past human activities during the Holocene in the northern Congo Basin, in archaeologically unexplored areas that are today covered by dense forest. Two phases of human expansion are highlighted, from 2300 to 1300 BP and from 670 to 20 BP, with an intermediate contraction phase. This chronology fits into the established archaeological framework and suggests a general trend in the history of human settlements across central Africa. The observed fluctuations in human populations raise the question of the extent of their impact on the environment through time. In particular, the second phase of human expansion may have triggered the recruitment of the long-lived light-demanding tree species some centuries ago, which currently dominate the canopy in the area.

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