

1 Pikunda-Munda and Batalimo-Maluba

**2 Archaeological Investigations of the Iron Age Settlement History of the
3 western and northern Congo Basin**

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7 Abstract The spread of pottery-producing communities into the Congo rainforest is
8 commonly linked to demic diffusion, driven by the so-called 'Bantu Expansion'. It is
9 considered the primary linguistic, cultural, and demographic process in Holocene sub-
10 Saharan Africa. A key region in reconstructions of this process is the western Congo
11 Basin. This paper presents, for the first time, a coherent picture of the archaeological
12 settlement history in the western and northern Congo Basin, uncovered by fieldwork
13 of the late 1980s along the rivers Ngoko, Sangha, Likwala-aux-Herbes, Ubangi,
14 andLua. Archaeological research of the *River Reconnaissance Project*, directed by
15 Manfred K. H. Eggert from 1977 to 1987, produced a pottery sequence for the region.
16 Archaeological features and findings uncovered during the project's field campaigns
17 in the northern and western Congo Basin have only recently been studied in detail.
18 The present analysis provides the only reliable source for the a reconstruction of
19 the cultural dynamics within the region due to lack of subsequent archaeological
20 fieldwork. Archaeological data and the sequence of pottery styles within the western
21 Congo Basin, along the Sangha river, cannot support the claim that this region, due to
22 a climate-induced extension of savannas, played a unique role as a 'corridor' within
23 the expansion of putatively 'Bantu' speaking groups during the latter half of the 1st
24 millennium BCE.

25 Résumé La progression des communautés productrices de poterie dans la forêt trop-
26 icale du Congo a été communément généralement liée à une diffusion démique,
27 entraînée par ce qu'on appelle "l'expansion Bantoue". Ce phénomène est consid-
28 éré comme le plus important processus linguistique, culturel et démographique de
29 l'Afrique subsaharienne durant l'Holocène. Une région clé pour la reconstruction de
30 ce processus est l'ouest du bassin du Congo. Cet article présente, pour la première

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31 fois, une image cohérente de l'histoire des peuplements archéologiques dans l'ouest
32 et le nord du bassin du Congo, basée sur des travaux de terrain menés à la fin des
33 années 1980 le long des rivières Ngoko, Sangha, Likwala-aux-Herbes, Oubangi et
34Lua. Les recherches archéologiques du *River Reconnaissance Project*, dirigées par
35 Manfred K. H. Eggert de 1977 à 1987, ont fourni une séquence de la céramique pour
36 la région. Cependant, les contextes archéologiques et les découvertes réalisées lors
37 des campagnes de terrain du projet dans le nord et l'ouest du bassin du Congo n'ont
38 été étudiés en détail que récemment. L'analyse présente ici constitue dès lors la seule
39 source fiable pour la reconstruction des dynamiques culturelles au sein de la région en
40 raison du manque de travaux archéologiques ultérieurs. Les données archéologiques
41 et la séquence des styles de poterie dans l'ouest du bassin du Congo, le long de la
42 rivière Sangha, ne permettent pas d'étayer l'affirmation selon laquelle cette région,
43 en raison d'une extension des savanes induite par le climat, a joué un rôle important
44 de "couloir" dans l'expansion de groupes de langues putativement "bantou" au cours
45 de la seconde moitié du 1er millénaire avant notre ère.

46 **Keywords** Congo Basin · Pottery · Iron Age · Settlement History

47 **Introduction**

48 The archaeological sequence in the Inner Congo Basin or *Cuvette centrale* has been
49 studied in detail (Wotzka 1995), while finds from the adjacent western and northern
50 fringes of the Congo Basin were analyzed only recently (Seidensticker 2021). This re-
51 gion is critical as prevailing models of the spread of sedentary lifestyle in sub-Saharan
52 Africa, regularly derived from linguistic reconstructions of modern languages, pro-
53 pose it as the route for substantial migrations (Bostoen 2018, 2020). Relying on
54 phylogenetic modeling and coupling their results with evolutionary genetic research,
55 historical linguists favor rapid expansion, driven by demic diffusion, into and through
56 the equatorial rainforests (Currie et al. 2013; Bostoen et al. 2015; Grollemund et al.
57 2015; Koile et al. 2022; Grollemund et al. 2023). Regularly, these findings are coupled
58 with an intensification of archaeological remains yielding ceramics in the second half
59 of the 1st millennium BCE (de Saulieu et al. 2021; Seidensticker et al. 2021).

60 While the key objective of the research summarized here, was to reconstruct
61 the settlement history of the northern and western Congo Basin, by establishing
62 a chrono-typological framework of pottery development (Seidensticker 2021), this
63 paper addresses three additional research questions: it gives a critical review of the
64 "Sangha River Interval" (SRI) Hypothesis including the archaeological ground-truths,
65 i.e. the missing signature of hypothesized migrations along the Sangha river valley
66 during the 1st millennium BCE (Currie et al. 2013; Bostoen et al. 2015; Grollemund
67 et al. 2015; Koile et al. 2022; Grollemund et al. 2023). Furthermore, this paper
68 addresses the decline in archaeological finds between the end of the Early Iron Age in
69 the 5th to 6th century CE and the onset of the Late Iron Age in the 10th century CE,
70 specifically a so far overlooked potential recess in human activity in the Congo Basin.
71 At last, this study examines regional differences in pottery finds along the Ubangi
72 river, hinting at a prolonged 'fuzzy border'.

73 History of Research

74 Among the first archaeological finds from the northern Congo Basin are partially
75 polished lithic artifacts, found during colonial times between Libenge, Dongo and
76 Gemena (Bequaert 1937, 1938, 1940, 1946). A first excavation was conducted at
77 Batalimo on the Lobaye river, a tributary of the Ubangi river, by Roger de Bayle des
78 Hermens (1969, 1971, 1975). The site was first discovered in 1966 during construction
79 works, and a 2 × 3 m big trench was excavated in 1968. The site was revisited in 1981
80 by Pierre Vidal and most notably between 1987 and 1990 by Lassina Koté (1992).
81 More recent excavations directed by Alfred Jean-Paul Ndanga et al. (2010) focused
82 on re-evaluating the cultural layer discovered by de Bayle des Hermens (1975), and
83 the debated co-occurrence of partially polished lithic artifacts and ceramics (Eggert
84 1987, 137). In the early 1970s, Francis van Noten (1977) conducted fieldwork in the
85 Ubangi region. Two notable sites were excavated, the rock-shelter of Hau, to the west
86 of Gemena, and Motenge-Boma on the middle Ubangi river (Fig. 1). The excavation
87 at Hau revealed three distinct layers, each characterized by a specific inventory. The
88 lowest layer contained lithic artifacts in Levallois technique and was thus dated into the
89 Middle Stone Age (van Noten 1982c, 27,30). Above that was a layer with microliths,
90 associated with the Late Stone Age, while the uppermost layer was characterized
91 by potentially Iron Age pottery (Bahuchet 1992, 31). Unfortunately, three charcoal
92 samples, one from each layer, were unsuccessfully radiocarbon dated, ending all
93 studies of the material as the site was deemed disturbed (van Noten 1982c, 27,30).
94 Motenge-Boma, the second site excavated by van Noten (1977) yielded a few remains
95 of pottery, all showing carved roulette (van Noten 1982a, Fig. 40) and dating into the
96 Late Iron age.

97 Between 1977 and 1987, extensive boat surveys along the tributaries of the Congo
98 river were performed in the context of the *River Reconnaissance Project*, directed
99 by Manfred K. H. Eggert (1983, 1984, 1993, 1996). A detailed analysis of this
100 project's discoveries in the Inner Congo Basin, south of the Congo river, has been
101 published by Hans-Peter Wotzka (1995). Wotzka's reconstruction of the settlement
102 history of the *Cuvette centrale* relies on a sequence of 35 pottery styles that span the
103 last two-and-a-half millennia and pertain to six stylistic traditions. Four, more local,
104 stylistic traditions, named after their main region of distribution "Luilaka", "Tshuapa",
105 "Busira", and "Maringa" show interconnections that were indicative of them sharing a
106 common ancestry within the "West tradition" (Wotzka 1995, 219–225 Fig. 4). Wotzka
107 (1995) condensed this evolutionary development into the "Equator-Co style tradition",
108 applying the concept similar to Rouse (1957), Huffman (1970), Schmidt (1975), Vogel
109 (1978), and Hall (1983). The initial phase of pottery in the Congo Basin dates from
110 400 to 200 BCE and is represented by the Imbonga style (Wotzka 1995, 59–68). The
111 expansion continued into the 16th century CE, and the first settlers did not penetrate
112 the entire region at once. Instead, the settling of the Inner Congo Basin occurred in
113 multiple successive waves of upriver expansions (Wotzka 1995, 226–241). Wotzka
114 (1995, 290) concludes that "the explored parts of the Inner Congo Basin constitute a
115 remarkably self-containing ceramic sphere in the course of the last 2 400 years" and
116 that "all [encountered] pottery styles could be traced back to the Imbonga group".

117 Aiming at uncovering the northern extent of the Imbonga style, fieldwork of the
118 *River Reconnaissance Project* was extended along the Ubangi river and its tributary,
119 the Lua river, in 1985 (Eggert 1987). The survey traversed the equatorial rainforest
120 up to the tropical savanna (Fig. 1). The roughly 850 km long exploration of the
121 Ubangi yielded 44 sites, of which only the site of Motenge-Boma had been published
122 prior (van Noten 1977, 1982b, 75). Four additional sites were discovered along an
123 approximately 100 km long stretch of the lower Lua river, most notably Maluba, where
124 multiple pit features were excavated. The only other site with an equally distinct record
125 like that uncovered at Maluba is Batalimo on the Lobaye river (de Bayle des Hermens
126 1969, 1971, 1975).

127 After the surveys along the Ubangi and Lua, which did not yield pottery associated
128 with the earliest styles from the Inner Congo Basin, the campaign of 1987 focused
129 on the western parts of the Congo Basin (Fig. 1; Eggert 1992). The nearly 600 km
130 long survey of the Sangha river, from its mouth at Mossaka – around 220 km south
131 of Mbandaka – up to Bomasa at the border triangle of the Republic of the Congo,
132 Cameroon, and the Central African Republic, yielded 38 new sites. A survey along a
133 roughly 80 km long stretch of the Ngoko river, which joins the Sangha north of Ouezzo,
134 added another eight sites. The last survey, the *River Reconnaissance Project* conducted
135 in 1987, covered the Likwala-aux-Herbes river, which runs in-between the Ubangi
136 and Sangha and is characterised by a very distinct ecology (Philippon et al. 2019).
137 The Likwala-aux-Herbes, not to be confused with the Likwala-Mossaka running
138 further west, is characterised by a swampy bush- and grassland. Denser vegetation
139 only appears multiple kilometres away from the river. Thus, a vast floodplain can
140 be found at each river bank, unlike along the Sangha river, where the rainforest
141 vegetation reaches directly to the river bank. The 530 km long survey yielded another
142 23 sites. The entire region surveyed was archaeological *terra incognita* before 1987.
143 The project's discoveries, including preliminary results from the western and northern
144 Congo Basin, were outlined in a well-known paper concerning the archaeology of the
145 equatorial rainforest (Eggert 1993). The survey and excavation finds were partially
146 summarized (Seidensticker 2016) until the detailed analysis was published recently
147 (Seidensticker 2021).

148 Fieldwork in the region re-commenced during the past decade. Contrasting earlier
149 endeavours is the prevalent integration of paleo-ecological research. Focal points of
150 research have been the Ngoto forest reserve in the south-western parts of the Central
151 Africa Republic (Kiahtipes et al. 2011; Lupo et al. 2015; Kiahtipes 2016; Lupo et al.
152 2021), the northern parts of the Republic of the Congo (Gillet 2013; Morin-Rivat et al.
153 2014; Morin-Rivat 2017), the north-eastern parts of the Congo Basin (Cornelissen
154 et al. 2013; Livingstone Smith et al. 2011, 2017), as well as the Inner Congo Basin
155 (Neumann et al. 2022).

156 Material culture and language

157 A defining paradigm when working with pottery finds from Central Africa concerns
158 the imposed link between this category of material culture and languages. The prevailing
159 model of the spread of sedentary lifestyle proposes a 'migration' of Bantu-speech

communities through the rainforest, often identified by the presence of pottery finds (Currie et al. 2013; Bostoen et al. 2015; Grollemund et al. 2015; Koile et al. 2022; Grollemund et al. 2023). At the core of an intense academic debate surrounding the term 'Bantu' (cf. Oliver 1966; Vansina 1979, 1980; Robertson and Bradley 2000; Eggert 2005, 2016) lies a profound conceptual trend in which a "purely technical [term] without any non-linguistic connotations was transformed into a designation referring indiscriminately to language, culture, society, and race" (Eggert 2005, 302). Research of the modern, about 300-600 languages spoken in sub-Saharan Africa summed up within the Bantu language family (Nurse and Philippson 2003; Bostoen 2018), resulted in two main models aimed at explaining their dispersion: an 'early split' of languages with predicted migrations on the northern fringes of the rainforest and through it, and a 'late split' model with migrations through the rainforest and subsequent diversification (Bostoen 2018, 2020). Pakendorf et al. (2011) claim that evolutionary genetic research on modern communities points towards demic diffusion as the driving force behind the expansion of Bantu languages in favor of trans-cultural diffusion of languages and technologies (Bostoen and Gunnink 2022). The proposed migrations are conceptualized as the exclusive driver for the initial spread of Bantu speech-communities. Any effects of recent population dynamics (cf. Vennetier 1963, 83) are equally omitted by such over-simplified reconstructions as setbacks in human activity (Oslisly 1998; Oslisly et al. 2013; de Saulieu et al. 2017, 2021; Seidensticker et al. 2021). Lipson et al. (2022, 1) point out that "the structure of ancient populations cannot be robustly reconstructed based solely on genetic data from present-day people" due to disruptions by "demographic transformations", including "colonialism, imperialism, enslavement, and modern sociopolitical reorganization". ?, 7 found "a marginally significant negative correlation between linguistics and genetic data [...] after controlling for geography [...] whereas both [individually] correlate strongly with geography". This finding points at "separate histories underlying the genetic and linguistic data" (*ibid.*) and in consequence that localized events shaped the overall process.

An unfortunate but common practice in order to 'date' nodes in historical linguistic reconstructions of modern Bantu languages is 'calibrating' them using archaeological data, claiming that changes in material culture can be equated with changes in languages (see Bostoen et al. 2015; Grollemund et al. 2015, 2023; Koile et al. 2022). This false assumption perpetuated the trope that early Bantu-speakers can be equated with the earliest pottery production in a given region (Bostoen et al. 2015, 355, 362, 364). It further suffers from disregarding the (dis-)continuities of a single facet of material culture in a given region and their relations to any historically identifiable human society. In a nutshell, the procedure of adopting opportune archaeological results for underpinning historical linguistic reconstructions by Grollemund et al. (2015) and Bostoen et al. (2015), which was subsequently adopted by Koile et al. (2022, SI) without any critical review, and reiterated by Grollemund et al. (2023) represents another facet of a long-standing tradition in circular reasoning (Ehret 1973; Phillipson 1976a,b, 1977; Heine et al. 1977) that has been reviewed in detail by Eggert (2005, 2016, 82). Such approaches induce 'procedural puzzles' and fail at linking linguistics with "the authentic material evidence of archaeology" (Eggert 2016, 88). de Maret (1989, 129) made clear that, from a methodological point of view, 'Bantu' is a lin-

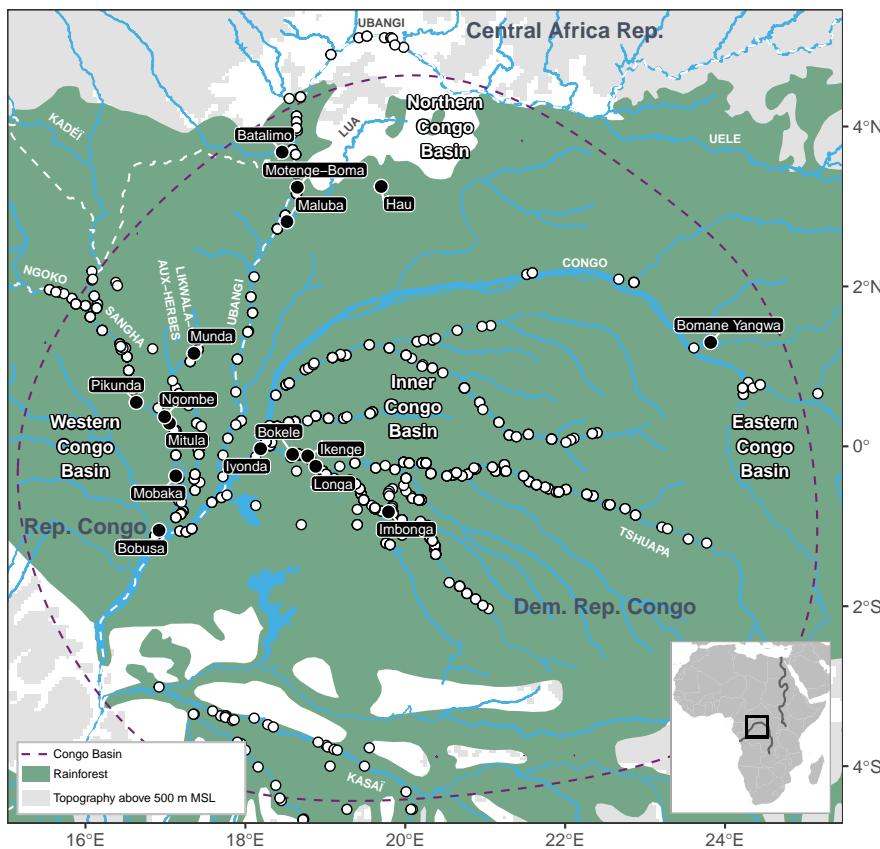


Fig. 1 Map of the Congo Basin. White dots are known sites with pottery finds (dark dots representing sites mentioned in the text). Green shading shows the modern extent of the equatorial rainforest (White 1983). The purple dotted line shows the extent of the Congo Basin (Runge 2001, 11), and grey shading the topography above 500 m ASL.

guistic term and that the 'mute' archaeological finds are not 'Bantu'. In consequence, it can only be acknowledged that "non-written languages do not leave material traces" (Eggert 2016, 85).

209 Landscape and Geography

210 The study area is a series of north-south transects through the rainforest west and
 211 north of the Congo River, as most surveyed rivers run north to south (Fig. 1). It
 212 covers the tropical savanna climate ('Aw'-climate according to the Köppen-Geiger
 213 systematic) in the north, followed by the tropical monsoon climate ('Am'), while the
 214 bulk of sites is located in tropical rainforest climate ('Af'; Peel et al. 2007). At the
 215 heart of the study area lies the Congo Basin, which is dominated by the Congo river
 216 and its many tributaries. The catchment area of the Congo river covers the entire area

217 of the Democratic Republic of the Congo (DRC) as well as large parts of the Republic
218 of the Congo, south-eastern Cameroon, the southern Central African Republic and
219 adjacent areas further east, south-east and south of the DRC (Eggert 2017, 60 Fig.
220 1). The Congo Basin is generally limited to a topography below 450 m ASL (Runge
221 2001, 11) and characterized by quaternary geological deposits (Persits et al. 1997).

222 For this review of the settlement processes, the study area is represented best when
223 subdivided into the “western Congo Basin” (rivers Ngoko, Sangha and Likwala-aux-
224 Herbes) and the “northern Congo Basin” (region of the Ubangi and Lua rivers)
225 (Fig. 1).

226 Materials and Methods

227 The research is based on inventories of 122 sites along the rivers Ubangi, Lua,
228 Sangha, Ngoko, and Likwala-aux-Herbes (Fig. 1). The study area covers an area of
229 about 500 × 700 km. In total, the studied collection is comprised of around 10.500
230 individual objects, including roughly 4.200 vessel units and a similar amount of highly
231 fragmented ceramic sherds (Seidensticker 2021, 23–43). At five sites, 14 features
232 were excavated. Most of the excavated features were pits. Additional pit features were
233 sampled at four sites. Only about a third of the studied ceramics was discovered during
234 excavations or deliberate sampling of clearly identifiable features.

235 Morphologically and ornamentally similar vessel units are summarized as pottery
236 styles, following the established conceptualizations of Wotzka (1995, 52–57). The
237 styles describe a specific and recognizable way ceramics are produced and decorated.
238 Throughout the text, the term ‘group’ is used synonymous for ‘style’. Additionally,
239 early investigations into clay sourcing, conceptualized as macroscopic pottery fab-
240 rics (Seidensticker 2021, 60–69), were included in the morphological description of
241 ceramic styles.

242 The study’s main objective was to develop a spatio-temporal reference frame-
243 work for the area based on pottery groups derived from the ceramics’ technological,
244 morphological, and ornamental characteristics found either on the surface or during
245 excavations. Twenty-four new ceramic style were described for the northern and west-
246 ern Congo Basin combined. Furthermore, five styles found mainly within the Inner
247 Congo Basin and described by Wotzka (1995) could be identified.

248 Established concepts were adopted (Eggert 1983, 295; 1984, 250, 257; 1988, 28–
249 31; Wotzka 1995, 217–225) to describe the change and development of pottery in the
250 study area. A sequence of subsequent pottery styles that share clear indications that
251 one was derived of the other are regarded as ‘pottery traditions’ or ‘style traditions’
252 (Rouse 1957; Willey 1945), while contemporaneous sets of closely related pottery
253 styles are summarized as ‘style horizons’ (Kroeber 1944, 108–111).

254 All data and computer code produced are available here: <https://github.com/>
255 [dirkseidensticker/PikundaMunda_BatalimoMaluba_AAR](https://github.com/dirkseidensticker/PikundaMunda_BatalimoMaluba_AAR)

Lab-No	C14	STD	Site	Feature	Potterystyle	calBCE/CE (2-Sigma)	Source
KI-2444	1930	120	Maluba	MLB 85/1-3-1	Batalimo-Maluba	340-324 BCE (0.7%) 200 BCE-384 CE (94.6%) 397-410 CE (0.1%)	Eggert 1987: 141 Tab. 2
GrN-13584	1670	110	Maluba	MLB 85/1-3-1	Batalimo-Maluba	130-144 CE (0.8%) 155-603 CE (94.7%)	Eggert 1987: 141 Tab. 2
KI-2445	2140	200	Maluba	MLB 85/1-3-2	Batalimo-Maluba	761 BCE-248 CE (95.2%) 298-306 CE (0.2 %)	Eggert 1987: 141 Tab. 2
GrN-13585	1990	60	Maluba	MLB 85/1-3-2	Batalimo-Maluba	149-135 BCE (1.3%) 115 BCE-205 CE (94.1%)	Eggert 1987: 141 Tab. 2
Poz-62102	580	30	Maluba	MLB 85/1-4-3	-	1305-1365 CE (64.6%) 1383-1419 CE (30.9%)	Seidensticker 2021: Appendix 2
Poz-62103	810	80	Maluba	MLB 85/1-4-3	-	1036-1302 CE (94.5%) 1370-1378 CE (1.0%)	Seidensticker 2021: Appendix 2
KI-2891	600	75	Pikunda	PIK 87/1	Mandombe	1278-1438 CE (95.4%)	Seidensticker 2021: Appendix 2
KI-2877	1980	100	Pikunda	PIK 87/1	Pikunda-Munda	347-315 BCE (1.7%) 205 BCE-251 CE (92.9%) 293-315 CE (0.9%)	Eggert 1992: 16 Tab. 3
KI-2892	840	41	Pikunda	PIK 87/1	Ebambe	1051-1080 CE (5.3%) 1153-1276 CE (90.2%)	Seidensticker 2021: Appendix 2
KI-2895	2230	100	Mitula	MIT 87/103	Imbonga	720-708 BCE (0.4%) 662-653 BCE (0.3%) 544-31 BCE (93.9%) 18 BCE-8 CE (0.9%)	Eggert 1992: 20 Tab. 4
KI-2894	2270	160	Mobaka	MKA 87/102	Imbonga	781 BCE-26 CE (95.2%) 49-56 CE (0.2%)	Eggert 1992: 20 Tab. 4
KI-2882	1110	110	Munda	MUN 87/1-0-1	-	675-1158 CE (95.4%)	Seidensticker 2021: Appendix 2
KI-2883	870	180	Munda	MUN 87/1-0-1	-	774-793 CE (1.0%) 798-1412 CE (94.4%)	Seidensticker 2021: Appendix 2
KI-2884	250	40	Munda	MUN 87/1-0-2	Ebambe	1508-1594 CE (24.4%) 1618-1686 CE (41.1%) 1732-1806 CE (26.1%) 1927-1955 CE (3.5%)	Seidensticker 2021: Appendix 2
KI-2885	1800	80	Munda	MUN 87/2-1-1	Pikunda-Munda	31-40 CE (0.5%) 60-420 CE (94.0%)	Eggert 1992: 16 Tab. 3
KI-2887	2020	180	Munda	MUN 87/2-1-1	Pikunda-Munda	469-435 BCE (0.6%) 423 BCE-418 CE (94.8%)	Eggert 1992: 16 Tab. 3
KI-2881	1990	45	Munda	MUN 87/2-1-1	Pikunda-Munda	102-66 BCE (3.4%) 61 BCE-131 CE (90.7%) 141-158 CE (1.0%) 192-200 CE (0.4%)	Eggert 1992: 16 Tab. 3
KI-2886	1910	80	Munda	MUN 87/2-1-1	Pikunda-Munda	93-76 BCE (0.9%) 55 BCE-259 CE (90.0%) 279-335 CE (4.6%)	Eggert 1992: 16 Tab. 3
KI-2888	1990	65	Munda	MUN 87/2-1-3	Pikunda-Munda	151-130 BCE (2.2%) 121 BCE-207 CE (93.3%)	Eggert 1992: 16 Tab. 3
KI-2876	1980	41	Munda	MUN 87/2-1-3	Pikunda-Munda	89-81 BCE (0.5%) 54 BCE-131 CE (93.5%) 142-157 CE (1.0%) 193-199 CE (0.4%)	Eggert 1992: 16 Tab. 3
KI-2890	1680	90	Munda	MUN 87/3	Pikunda-Munda	204-590 CE (95.4%)	Eggert 1992: 16 Tab. 3
KI-2889	1650	80	Munda	MUN 87/3	Pikunda-Munda	241-575 CE (95.4%)	Eggert 1992: 16 Tab. 3
KI-2893	1960	90	Likwala-aux-Herbes Km 186	LKW 87/186	-	176 BCE-251 CE (94.5%) 294-314 CE (0.9%)	Eggert 1992: 20 Tab. 4

Tab. 1 Calibrated ages (Reimer et al. 2020) of previously published radiocarbon dates from the fieldwork of the *River Reconnaissance Project* in the western and northern Congo Basin (Seidensticker 2021, Appendix 2).

Lab-No	C14	STD	Site	Feature	Potterystyle	calBCE/CE (2-Sigma)	%C	%N	d13C	d15N	at C.N
RICH-30864	1850	24	Pikunda	PIK 87/1	Pikunda-Munda	126-240 CE (95.4%)	44,9	3,1	-26,6	7,7	16,9
RICH-30865	192	22	Munda	MUN 87/1-0-2	Ebambe	1657-1688 CE (22.2%) 1730-1807 CE (58.4%) <1925 CE (14.8%)	55,7	6,4	-26,2	9,3	10,2
RICH-30866	328	22	Munda	MUN 87/1-0-2	Ebambe	1490-1639 CE (95.4%)	54,4	4,5	-26,1	8,8	14,2
RICH-30867	841	24	Ngombe	NGO 87/102	Ngombe	1167-1262 CE (95.4%)	16,5	1,0	-25,7	6,8	19,6

Tab. 2 Calibrated ages (Reimer et al. 2020) of newly obtained AMS dates of foodcrusts from the interior of ceramic vessels and stable isotope values. Legacy radiocarbon dates can be found in Tab. 1, the online aDRAC repository (Seidensticker and Hubau 2021) and as a supplementary data table (Data S1).

256 Radiocarbon Dating

257 In total, 21 conventional radiocarbon samples were dated in the 1980s (Tab. 1). All
258 dates were obtained from charcoals found within the respective feature. Two additional
259 samples from bone material were AMS dated in 2014 (Seidensticker 2021, 355–356
260 Appendix 2). All dates are also available via the aDRAC online repository (<https://github.com/dirkseidensticker/aDRAC>; Seidensticker and Hubau 2021). Four
261 samples obtained off food crusts from the interior of ceramics were AMS dated,
262 providing for the first time direct and precise dates associated with the usage of
263 the pottery (Tab. 2). Stable carbon and nitrogen isotopes were also measured to
264 compensate for fresh-water reservoir effects.

266 Bayesian Phase Modeling

267 The previously determined chronological ranges of the radiocarbon-dated pottery
268 groups (Seidensticker 2021; Seidensticker et al. 2021) were further examined using
269 Bayesian phase modeling. While Crema and Kobayashi (2020) relied on the OxCal
270 software to run their model, an implementation that is available via the nimbleCarbon
271 R-package was used (Crema and Di Napoli 2021; Crema and Shoda 2021). The code
272 used to define the model was derived of the vignette provided with the nimbleCarbon
273 software. A simple Bayesian chronological model was fitted to all radiocarbon dates
274 of a given pottery style that showed sufficient archaeological contextualization and
275 have not been discarded as potential lab errors in prior studies (Seidensticker et al.
276 2021, 9) and posterior probabilities for its onset and end were recovered (Fig. S1). To
277 compare these with the conventional estimations provided in earlier studies (<https://github.com/dirkseidensticker/aSCAC>; Seidensticker et al. 2021, Data S2),
278 the median age value of the posterior distribution was extracted (Tab. S1).

280 Results**281 Early Iron Age (400 BCE – 500 CE) in the Western Congo Basin****282 *Imbonga* style**

283 Remnants of the oldest ceramics in the western Congo Basin are found at two sites
284 along the lower Sangha river, at Mitula and Mobaka (Fig. 1; Seidensticker 2021,
285 169–172, 306–307). At both villages, fragments of diagnostic vessels were found
286 partially embedded in the soil, indicating eroded remains of pit features. During
287 the pottery's extraction, charcoal was found and subsequently radiocarbon dated.
288 Charcoal from inside the vessel at Mobaka dates to the 8th to 1st centuries BCE
289 (KI-2894; Tab. 1), while the sample from underneath the vessel at Mitula dates to the
290 6th to 1st centuries BCE (KI-2895; Tab. 1; Fig. 2). Both conventional radiocarbon
291 dates show substantial standard errors and thus cover long timespans after calibration.
292 These dates correspond to the age of the *Imbonga* style from the Inner Congo Basin,
293 dated to the 4th to 1st centuries BCE and constituting the initial phase of pottery

294 producing communities in the Congo Basin (Fig. 2; S1; Tab. S1; Wotzka 1995, 59–
295 68). The Imbonga style is characterized by vessels with flat bases that either show
296 round bellies, pronounced shoulders, and profiled rims or are wide-mouthed bowls.
297 Its decoration patterns comprise of rocker-stamping on the lower half, often combined
298 with horizontal grooves and incised or plastic ornamentation on the vessels' shoulder
299 regions (Seidensticker 2021, 196 Fig. 93.1–4). The two mentioned vessels found on the
300 lower Sangha river do not represent classic Imbonga characteristics but show striking
301 similarities to vessels associated with the Imbonga style (Seidensticker 2021, 170
302 Fig. 84): the vessel found at Mitula resembles another from Iyonda (Wotzka 1995,
303 441 Pl. 7.7) while the vessel from Mobaka matches one found at Bokele (Wotzka
304 1995, 453 Pl. 19.10). These relatively isolated finds indicate an area of influence the
305 Imbonga group had west of its previously known boundary.

306 *Pikunda-Munda style*

307 The Pikunda-Munda group represents the earliest pottery style in the western parts
308 of the Congo Basin (Eggert 1992; Seidensticker 2021, 114–120). It shows substantial
309 similarities to the contemporaneous groups in the Inner Congo Basin regarding pottery
310 technology and decorations. However, concerning vessel shapes, there are consider-
311 able differences (Wotzka 1995, 107 Ftn. 4). The Pikunda-Munda style is represented
312 best through the inventories of pit features excavated in 1987 at the two eponymous
313 sites: Pikunda on the middle Sangha river and Munda on the upper Likwala-aux-
314 Herbes river (Fig. 1). The excavation at Pikunda detected two features: one about
315 3.4 m deep pit dating from the 4th century BCE to the 3rd century CE (KI-2877;
316 RICH-30864; Tab. 1; 2) that's been intersected by a considerably younger pit (Sei-
317 densticker 2021, 288–300). The older pit contained two nearly complete vessels and
318 around 160 sherds that can be attributed to the Pikunda-Munda style, as well as one
319 rim sherd of the Lusako style known from the Inner Congo Basin (Eggert 1992, 18
320 Fig. 4.1; Wotzka 1995, 104—107). Four sherds show a considerably different fabric,
321 shape, and decoration similar to that of the Ngbanja pottery known from the middle
322 Ubangi river (Seidensticker 2021, 296 Tab. 34). At Munda, two pits and a metallurgy-
323 related feature yielded inventories of the Pikunda-Munda style (Seidensticker 2021,
324 321–339). All features dated between the 1st century BCE and 4th century CE (Fig. 2;
325 S1; Tab. S1). The inventories from these pits are quite different compared to the
326 one excavated at Pikunda, whose pottery is heavily fragmented. The pits at Munda
327 contained complete vessels intentionally deposited either upside-down or lying on
328 their side; a practice reminiscent of the depositions in pits in the Inner Congo Basin
329 (Wotzka 1993). Overall nearly 550 vessel units are attributed to the Pikunda-Munda
330 style, with two-thirds of the assemblage originating from the excavations at the two
331 eponymous sites.

332 Pikunda-Munda pottery was found along the Sangha river from its mouth into
333 the Congo river in the south up to the village of Ikelemba, around 65 km south-east
334 of Ouezzo, and along the entire stretch of the Likwala-aux-Herbes river (Fig. 4B–D;
335 Seidensticker 2021, 119 Fig. 49). A vessel from Ingonda Bosopela along the lower
336 Lulonga river (Wotzka 1995, 119 Ftn. 4, 531 Pl. 97.5) and a few isolated sherds found

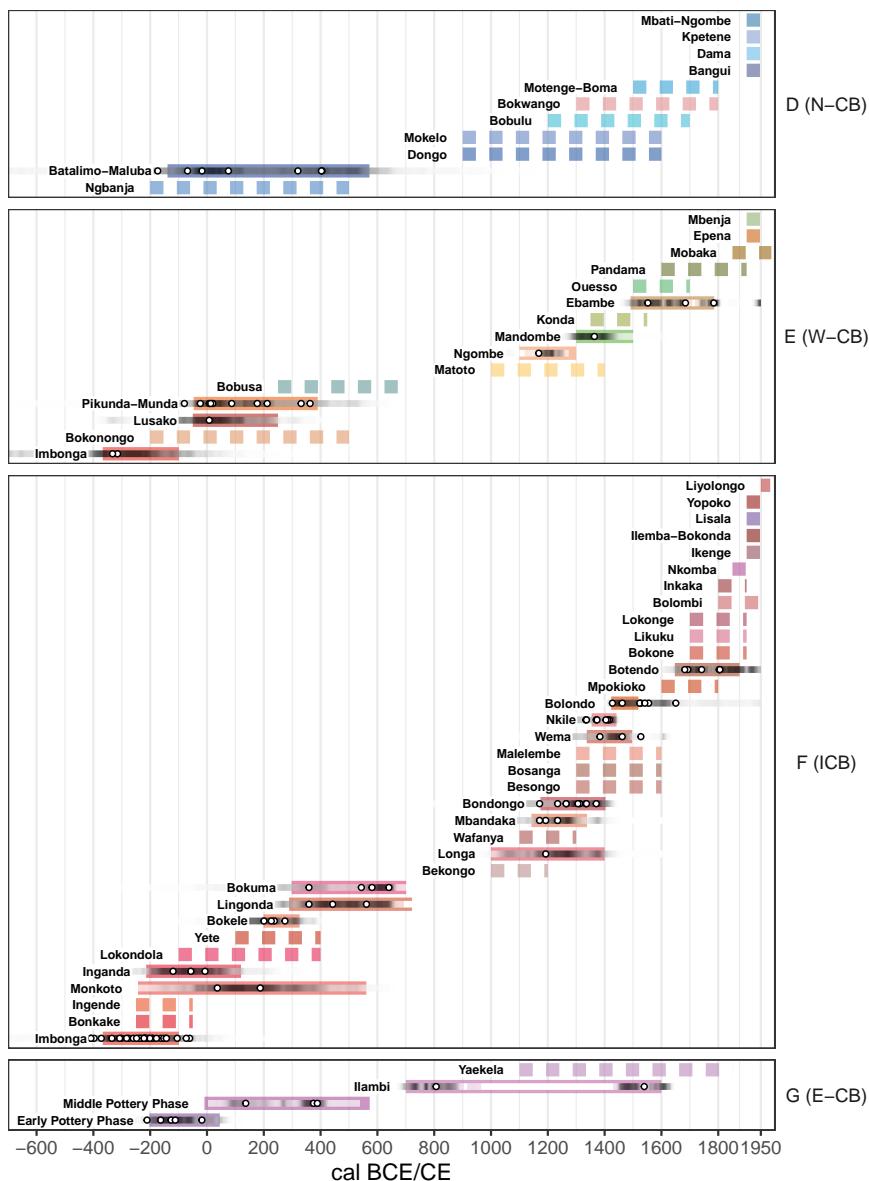


Fig. 2 Temporal distribution of known radiocarbon-dated pottery styles (solid colored bars) and styles with estimated 100-year bins derived from stylistic resemblance (dashed bars; Seidensticker et al. 2021, Data S2) in the Congo Basin over the past 2600 years separated by regions (Seidensticker et al. 2021, Fig. 1): D) Northern Congo Basin, E) Western Congo Basin, F) Inner Congo Basin, G) North-Eastern Congo Basin. Circles represent the highest probability of calibrated calendar age of each pottery-linked 14C date. The intensity of grey-shading is proportional to the summed probability of the calendar-age windows of all pottery occurrences by type. Colored bars represent the phase duration of radiocarbon dated pottery styles. For groups with more than two associated radiocarbon dates, the median start and end dates of the phases were calculated using a Bayesian phase model (Fig. S1; Tab. S1).

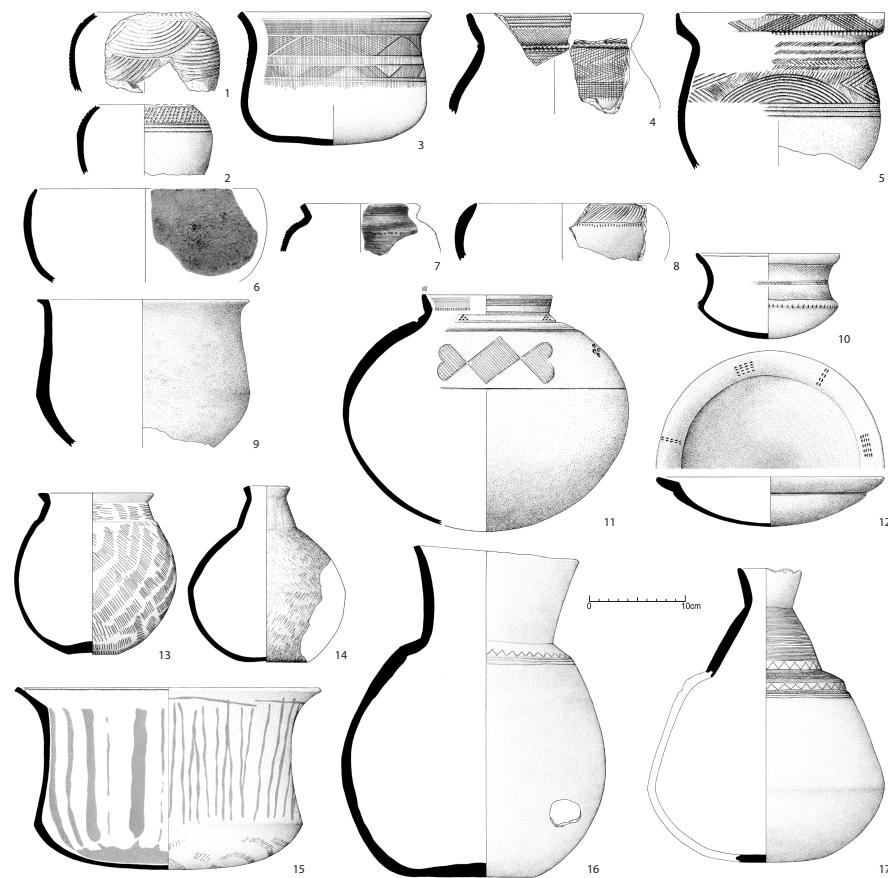


Fig. 3 Ceramic vessels from the western Congo Basin – along the rivers Ngoko, Sangha and Likwala-aux-Herbes – that are representative for the following pottery styles: 1–2) Imbonga; 3–4) Pikunda-Munda; 5) Bokonongo; 6–8) Bobusa; 9) Matoto; 10–12) Ngombe; 13–14) Ebambe; 15) Moba; and 16–17) Epena (Seidensticker 2021, 114–144, 162–172).

337 south-east and north-east of Ouesso (Gillet 2013, 114 Fig. 42) can be attributed to the
 338 Pikunda-Munda style as well.

339 The main characteristic of the Pikunda-Munda pottery are wide, open-mouthed
 340 carinated bowls with approximately cylindrical or slightly concave walls, flared rims
 341 and rounded bases (Fig. 3.3; Eggert 1993, 311–314). Ornamental motives are based
 342 on linear elements produced through incisions or grooves, as well as occasional
 343 rocker-stamp decoration (Seidensticker 2021, 362 Appendix 4.12). Utilizing of these
 344 decoration techniques and motives corresponds to contemporaneous practices in the
 345 Inner Congo Basin. Especially concerning their decoration, there are considerable
 346 similarities between the Pikunda-Munda style and the styles Lokondola, Lusako, Lin-
 347 gonda, and Bokuma (Wotzka 1995, 107). The main difference to the contemporaneous
 348 ceramics of the Inner Congo Basin is that among Pikunda-Munda pottery, only round
 349 bases are observed, while the ceramics further east unanimously show flat bases.

350 Irrespective of these morphological differences, in terms of macroscopic fabrics, Pikunda-Munda sherds and pottery from the Inner Congo Basin are practically
351 indistinguishable. Pikunda-Munda pottery is made from fine river clays that were
352 not tempered (Seidensticker 2021, 66–67 Fig. 21). The used clays proved to be rich
353 in sponge spicules (Seidensticker 2020). A small-scale pilot study on their shaping
354 techniques showed that Pikunda-Munda vessels are roughed out by a version of the
355 drawing of a ring technique (Seidensticker 2021, 47–51 Fig. 13; 72–73 Tab. 13), and
356 thus in similar fashion to the pottery production observed in the late 1970s and early
357 1980s at Ikenge in the Inner Congo Basin (Eggert and Kanimba-Misago 1980).

358 The oldest feature in the Congo Basin associated with iron metallurgy thus far
359 pertains to the Pikunda-Munda group: the upper part of a pit at Munda on the upper
360 Likwala-aux-Herbes river contained 7.5 kg of iron slag partially embedded in a hard-
361 fired clay lining (Seidensticker 2021, 321–330). The feature also contained five nearly
362 complete Pikunda-Munda bowls deposited laying on their sides (Seidensticker 2021,
363 323 Fig. 157.A–E; Pl. 91.1–5). Two radiocarbon dates from that part of the feature
364 date into the 1st to 4th centuries CE (Tab. 1: KI-2885, KI-2887).

365 Neither the precursor nor a potential successor of the Pikunda-Munda pottery is
366 known. The precise association between the Pikunda-Munda style and contemporane-
367 ous styles of the Equator-Co style tradition remains a subject for subsequent research.
368 The present state of knowledge points to the Pikunda-Munda group being a remote
369 sub-stream of the *Equator-Co* style tradition and no completely independent entity.

371 *Other Finds*

372 Several vessels from a partially eroded pit on the banks of the Likwala-aux-Herbes
373 river at kilometer 186 have no comparison in the region in terms of vessel shapes
374 and decorations (Seidensticker 2021, 165–168, 339–340). Time constraints during
375 fieldwork only allowed a quick sampling of the pit, obtaining a nearly complete
376 vessel, four larger fragments and 13 smaller sherds (Eggert 1993, 320 Fig. 16.15;
377 Seidensticker 2021, Pl. 76.1–11). A charcoal sample dates this features between the
378 2nd century BCE to the 3rd century CE (Tab. 1: KI-2893). The vessel has a flat base,
379 convex belly, and a slightly elaborated shoulder leading to a concave neck and a flared
380 rim. Its decoration consists of crudely made crossing grooves made with a comb
381 on the shoulder and impressions beneath the rim. Further fragments show similar
382 decorations. Overall, the vessel's shape is substantially different from those of the
383 contemporaneous Pikunda-Munda style. Some aspects of the ceramics superficially
384 resemble a vessel found at Gbadolite on the upper Ubangi river (Eggert 1984, 277–
385 278 Fig. 7). Loosely similar in terms of vessel shapes, decoration technique, and
386 motives is the pottery of the Ngovo group of the Lower Congo region (de Maret 1986;
387 Seidensticker 2021, 167 Fig. 81).

388 The Bokonogo style is an interim term for an inventory of 19 vessel units from
389 seven sites, including Pikunda on the middle Sangha river, that show very distinct
390 characteristics: all vessels are either rather tall with convex bellies and concave necks
391 ending in cylindrical rims or bowls with inverted rims (Fig. 3.4; Seidensticker 2021,
392 120–123). Decorations consist of grooves beneath the rim and on the neck and shoul-
393 ders, mainly forming horizontal, chevron or crossing motives. About half of the in-

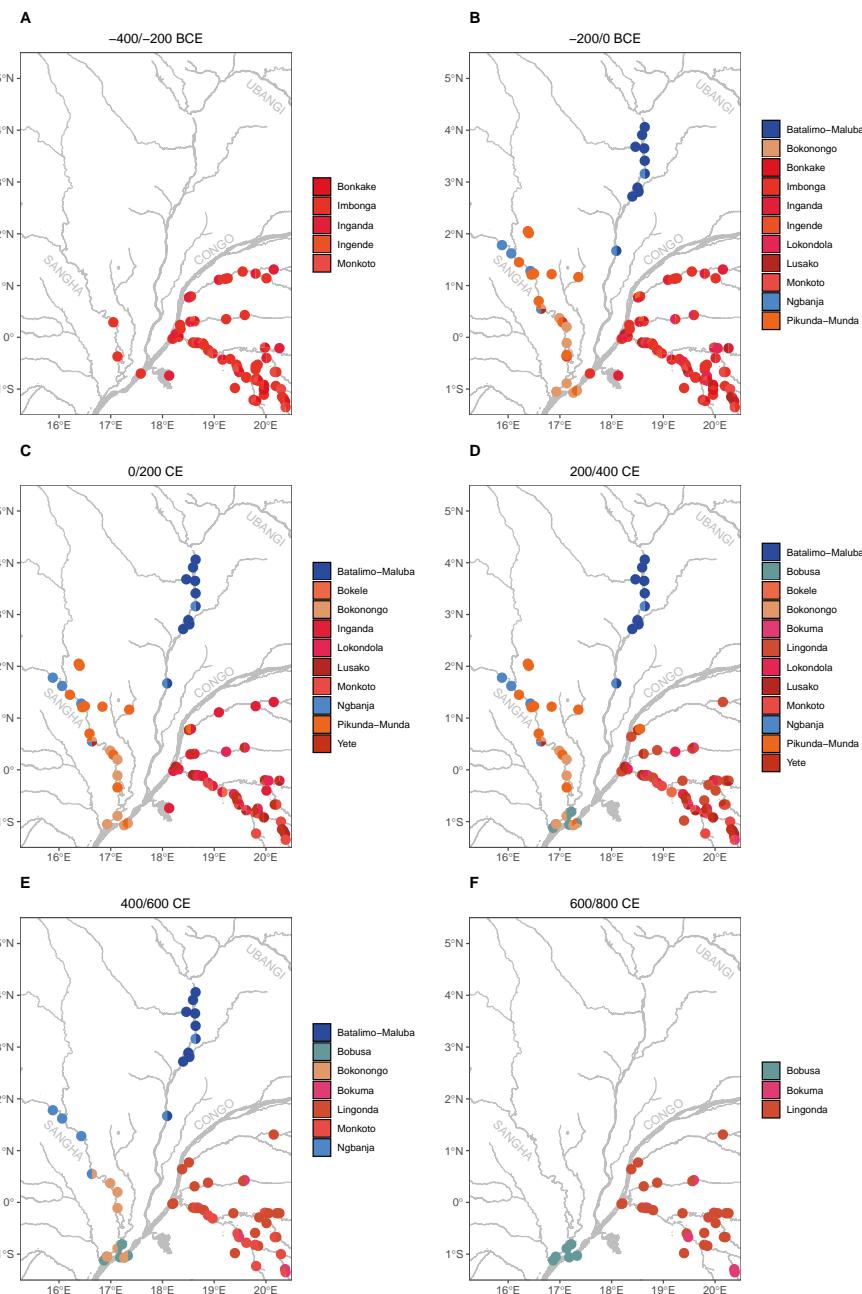


Fig. 4 Time-sliced maps of occurrences of pottery styles from both surface and excavated locations in the northern and western Congo Basin dating between the 4th century BCE to 8th century CE. If multiple contemporaneous pottery styles were recorded at a site, the colored icon is divided following Seidensticker (2021, 218–244 Fig. 100–107). Colors correspond to Fig. 2.

394 ventry showed a fabric similar to that of the Pikunda-Munda group, while a quarter
395 showed grog tempering. At the same time, the remainder contained a heterogenous mix
396 of quartz and grog. All finds are surface finds and not associated with any indications
397 of their dating. The only loose comparison in terms of morphological characteristics
398 and decorations can be made towards the Oveng pottery found in north-western Gabon
399 (Clist 2004, 615–618) and on the island of Corisco (Equatorial Guinea) dating into
400 the 1st to 7th century CE (Clist 2004, 555 Fig. 7–14; González-Ruibal et al. 2011;
401 2012; Sánchez-Elipe 2015, 217–221; Sánchez-Elipe et al. 2016, 351–355).

402 Close to the mouth of the Sangha river, in the very south of the study area, a unique
403 kind of pottery was found that is characterized by predominant grog tempering and
404 small globular pots with short everted rims or convex bowls with slightly inverted
405 rims (Fig. 3.6–8; Seidensticker 2021, 162–165). This group is named after the site of
406 Bobusa, located near the mouth of the Sangha river. While there are no radiocarbon
407 dates available for this pottery group, some of its characteristics show similarities to
408 pottery found on the Île des Mimosas in Kinshasa (Eggert 1984, 279–280).

409 Early Iron Age (200 BCE – 500 CE) in the Northern Congo Basin

410 The 1985 survey along the Ubangi river from its mouth into the Congo river south of
411 Mbandaka up to Kouango and along the Luá river (Fig. 1) yielded a first glimpse into
412 the variability of ceramics in the northern parts of the Congo Basin. The distribution
413 of pottery groups in the northern Congo Basin is separated into three distinct regional
414 lines of development (Seidensticker 2021, 183–185): only along the middle part of
415 the Ubangi river, from around 180 to 240 km upstream of its mouth into the Congo
416 river up to Bangui, pottery dating into the late 1st millennium BCE to 1st millennium
417 CE was uncovered (Fig. 8).

418 *Batalimo-Maluba style*

419 In the region between Impfondo and Bangui, henceforth referred to as the middle
420 Ubangi river, the ceramic sequence starts with the Batalimo-Maluba style (Seiden-
421 sticker 2021, 75–82), named after the eponymous sites Batalimo on the lower Lobaye
422 river and Maluba on the lower Luá river (Fig. 1). Excavations at Batalimo were con-
423 ducted by de Bayle des Hermens (1975), Vidal, Koté (1992) and Ndanga et al. (2010).
424 The initial excavation indicated a coexistent of partially polished lithic artifacts and
425 ceramics (Aumassip 1975). This was not supported by later excavations at the site
426 (Ndanga et al. 2010), nor excavations at the other eponymous site Maluba (Eggert
427 1987). Pottery of the Batalimo-Maluba style was found at 18 sites, with a core dis-
428 tribution area between Dongo near the mouth of the Luá river and Mokelo, about
429 30 km downstream of Bangui. The most southern find was uncovered at Ngbanja near
430 Impfondo (Fig. 4B–E; Seidensticker 2021, 81 Fig. 25). Only in Batalimo and Maluba
431 excavations yielded pottery of this style. The other sites associated with this group
432 originate from surface finds. Available radiocarbon dates and one thermolumines-
433 cence date (OxTL-154a-4), indicate that the Batalimo-Maluba pottery dates between



Fig. 5 Ceramic vessels from the northern Congo Basin – along the rivers Ubangi and Luá – that are representative for the following pottery styles: 1–3) Batalimo-Maluba; 4–5) Ngbanja; 6–7) Bobulu; 8–9) Mokelo; 10–13) Motenge-Boma; 14–15) Bondongo; 16) Mbandaka; 17–18) Bokwango; 19–20) Dama; 21–22) Mbatis-Ngombe; 23) Bangui; 24) Kpetene; and 25) Botendo (Seidensticker 2021, 75–114, 172–181).

434 the 2nd century BCE and 6th century CE (Fig. 2; S1; Tab. S1; Seidensticker 2021, 80
435 Fig. 28).

436 Batalimo-Maluba pottery is characterized by well-structured, flat-based globular
437 pots and wide-mouthed bowls that are elaborately decorated using cross-hatching,
438 impression motifs and incised or grooved lines organized in alternating horizontal
439 and vertical zones (Fig. 5.1–3; Eggert 1993, 306–308; Seidensticker 2016, 118; 2021,
440 75–82).

⁴⁴¹ *Ngbanja style*

⁴⁴² Closely related to the Batalimo-Maluba style is the Ngbanja style, which shares
⁴⁴³ its general characteristics (Seidensticker 2021, 82–86). The primary vessel types are
⁴⁴⁴ globular or slightly ovoid pots or beakers with everted rims (Fig. 5.4–5). Decorations
⁴⁴⁵ are based on grooves and impressions, and while they show similar motives as the
⁴⁴⁶ Batalimo-Maluba style, they are restricted to the neck or inside of the rim.

⁴⁴⁷ Ngbanja pottery is strongly related to the Batalimo-Maluba style, and Eggert
⁴⁴⁸ (1987, 141) suggested it as a predecessor of the Batalimo-Maluba group. Besides the
⁴⁴⁹ stylistic connections, the only chronological fixpoint for the Ngbanja style is a sherd
⁴⁵⁰ of this style found in the deep pit at Pikunda (Sangha river). Two radiocarbon dates
⁴⁵¹ (Tab. 1: KI-2877; Tab. 2: RICH-30864) date the feature to the second half of the 1st
⁴⁵² century BCE to the late 3rd century CE. The sherd exhibits a coarse fabric instead of the
⁴⁵³ delicate fabric common to the Pikunda-Munda style, and its decor consists of a ledge
⁴⁵⁴ with comb impressions on it. A nearly matching sherd was found during surveys at
⁴⁵⁵ Ngbanja on the middle Ubangi river (Seidensticker 2021, 83 Fig. 26.7–8). At Pikunda,
⁴⁵⁶ this sherd must be considered a foreign but contemporaneous type within the closed
⁴⁵⁷ Pikunda-Munda inventory. Three other sherds with coarse fabric and a decoration
⁴⁵⁸ different from the Pikunda-Munda style were also found. These associations allow for
⁴⁵⁹ the possibility that Ngbanja pottery is contemporaneous not only to Batalimo-Maluba
⁴⁶⁰ pottery but also to the Pikunda-Munda style and dates between the 2nd/1st century
⁴⁶¹ BCE and the 5th/6th century CE (Fig. 2; 4B–E).

⁴⁶² *Hiatus (500–1000 CE) in the Congo Basin*

⁴⁶³ In both regions, inventories dating between the end of the 6th century to the early 10th
⁴⁶⁴ century CE are currently unknown, leaving a gap within the regional sequences of at
⁴⁶⁵ least 300 years (Fig. 2; 4F–6A; S1). A detailed review of chronological indicators for
⁴⁶⁶ the 32 pottery styles described by Wotzka (1995, 59–212) revealed a similar pattern:
⁴⁶⁷ no pottery could be dated between the end of the styles Bokuma and Lingonda, which
⁴⁶⁸ end towards the end of the 7th centuries CE, and the onset of the widespread Bondongo
⁴⁶⁹ style at the beginning of 12th century CE (Fig. S1; Tab. S2).

⁴⁷⁰ In the north-eastern Congo Basin, around Kisangani (Fig. 1), a similar interrup-
⁴⁷¹ tion between ceramics designated to the Early and Middle Pottery Phase and styles
⁴⁷² pertaining to the Late Iron Age has been observed (Livingstone Smith et al. 2017,
⁴⁷³ Fig. 2; S1). Technological analyses of the shaping techniques revealed a distinction as
⁴⁷⁴ well: the pottery of the Early and Middle phases is exclusively shaped via a drawing of
⁴⁷⁵ a ring technique, while all Late Iron Age pottery is shaped by pounding in a concave
⁴⁷⁶ mold. Only certain stages of the *chaînes opératoires* of the Late Iron Age ceramics
⁴⁷⁷ still adhere to principles followed during earlier times, indicating a certain continuity
⁴⁷⁸ (pers. comm. Livingstone-Smith 2021).

479 Late Iron Age (1000–1850 CE) in the Western Congo Basin

480 After the interruption of pottery sequences during the 6th to 10th century CE, ceramics
481 re-appear within the archaeological inventories of the region in the 10/11th century
482 CE (Fig. 2; 6A–B; S1). During the late Iron Age in the western Congo Basin, a clear
483 distinction appears between pottery styles associated with the adjacent Inner Congo
484 Basin and an independent stream summarized as Ngoko style tradition.

485 *Ngombe style*

486 The re-emergence of ceramics in the western Congo Basin at the onset of the Late
487 Iron Age is marked by the Ngombe style (Seidensticker 2021, 125–128), which is
488 rooted in the Equator-Co tradition of the Inner Congo Basin (Wotzka 1995, 222 Fig.
489 4). The ceramics of this type are found mainly on the lower Sangha river, with the
490 eponymous site of Ngombe constituting the northernmost extension of its distribution
491 area (Seidensticker 2021, 127 Fig. 54). In total, 56 vessel units from 15 sites are
492 associated with the Ngombe style. They are similar to the styles Longa and Mbandaka
493 (Wotzka 1995, 121–128, 139–143) of the Inner Congo Basin but show equally inde-
494 pendent characteristics. The defining inventory of the Ngombe style was discovered in
495 a partially eroded pit at the eponymous site on the middle Sangha river (Seidensticker
496 2021, 305–306). It yielded an inventory of two plates, a big bowl, and a carinated
497 bowl, all surrounded by fragments of a large vessel with a convex belly, a tapered
498 shoulder and a short, flared rim (Fig. 3.10–12; Seidensticker 2021, Pl. 42.15–44.2).
499 Ngombe pottery only shows rounded bases and decorations consist of grooves and
500 impressions on the upper parts of the vessels. A new radiocarbon date obtained off
501 a food crust from the bottom of the main vessel found at Ngombe dates into the late
502 12th to mid 13th century CE (RICH-30867; Tab. 2). This corroborates the previously
503 proposed age of this pottery in relation to the Mbandaka and Longa styles of the Inner
504 Congo Basin (Fig. 2; 6B–C; S1; Tab. S1; Seidensticker 2021, 126–128).

505 *Ebambe and Epena styles*

506 Modern pottery production in the western Congo Basin shows two styles being present
507 along the Likwala-aux-Herbes river: upstream dominates the Epena style, while down-
508 stream, the Ebambe style is more present, but with vessels of both styles being found
509 along the entire length of the river (Seidensticker 2021, 131–141). Only the Ebambe
510 style has been found along the lower Sangha river. A potter in Boleko, on the lower
511 Likwala-aux-Herbes river, was still producing pottery of the Ebambe style in 1987
512 using a drawing of a lump technique combined with additional coiling for the neck
513 (Eggert in prep.). Diagnostic shapes include tall vessels with tapered necks, bottles
514 with long necks and bowls with parallel rims (Fig. 3.13–14; Seidensticker 2021, 132
515 Fig. 57). All vessels of the Ebambe style show flat bases. A diagnostic feature of the
516 Ebambe pottery is the consistent use of *banfwa-nfwa* decor on nearly all parts of the
517 vessel, including occasionally the inside of the rims. *Banfwa-nfwa* is the characteris-
518 tic decoration technique employed by potters at Ikenge (Eggert and Kanimba-Misago
519 1980, 399) and can be found on most of the pottery of the Inner Congo Basin after

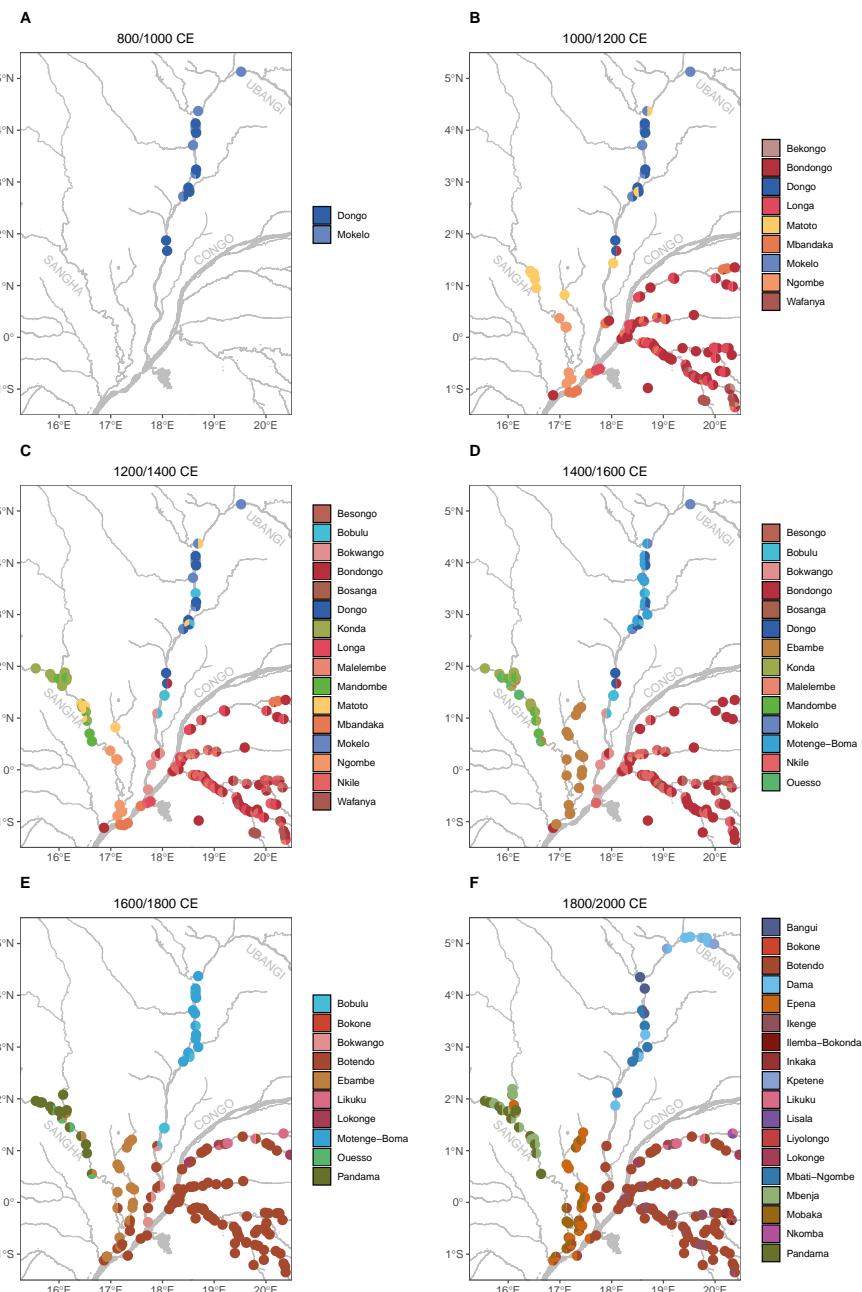


Fig. 6 Time-sliced maps of occurrences of pottery styles from both surface and excavated locations in the northern and western Congo Basin dating younger than the 9th century CE. If multiple contemporaneous pottery styles were recorded at a site, the colored icon is divided following Seidensticker (2021, 218–244 Fig. 100–107). Colors correspond to Fig. 2.

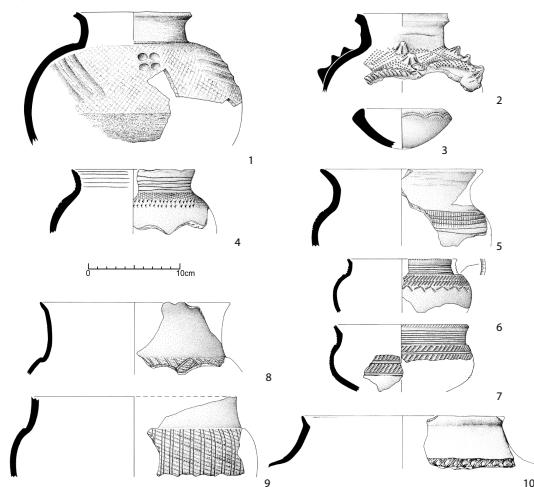


Fig. 7 Ceramic vessels of the Ngoko style tradition – along the rivers Ngoko and Sangha – that are representative for the following pottery styles: 1–3) Mandombe; 4–5) Konda; 6–7) Ouesso; 8–9) Pandama; and 10) Mbenja (Seidensticker 2021, 145–162).

the onset of the Late Iron Age (Wotzka 1995, 109–111). It is created by whipping the leather hardened clay with the narrow side of a chip made from the rib of a palm leaf, leaving short, mostly lancet-shaped impressions (Fig. 3.13–14; 5.16,25; Eggert 1980, 386 Ftn. 5).

A rich inventory of Ebambe style vessels was excavated in Munda on the upper Likwala-aux-Herbes river (Seidensticker 2021, 311–321). New radiocarbon dates on food crusts from two vessels found within the pit (Tab. 2: RICH-30865–RICH-30866) corroborate the existing conventional date (Tab. 1: KI-2884). All three dates cover the 16th century CE onwards.

The pottery produced at Epena on the upper Likwala-aux-Herbes river shares similar morphological features with the Ebambe style, especially their flat bases and tall vessels with tapered necks (Fig. 3.16–17; Seidensticker 2021, 137–141). Production was documented in 1995 by Léopold Mpika Ngoma (1996, 25–33). Epena ceramics – labeled 'Jeke' in Seidensticker (2016, 119 Fig. 6.3) – were shaped via drawing of superimposed rings. Most vessel shapes show relatively straight walls with slight tapering on the largest diameter and everted rims (Seidensticker 2021, 138 Fig. 60). Decorations are usually reserved for the shoulder and neck area. The rims are regularly undecorated, and – unlike the Ebambe pottery – bellies are not decorated with *banfwa-nfwa*. There are no chronological indicators for the onset of the Epena style available.

Ngoko style tradition

Between the 13th to 15th centuries CE, a set of ceramics emerged that showed no connection to the Equator-Co tradition and constituted an independent style tradition (Fig. 7). Two out of the five pottery styles forming the Ngoko style tradition are

dated: the Mandombe style (Seidensticker 2021, 145–148), which was defined after the inventory excavated in the upper pit at Pikunda, dates into the 13th to 15th century CE (Tab. 1: KI-2891), and the Mbenja style (Seidensticker 2021, 158–162), which represents the modern pottery along the upper Sangha and the Ngoko. The other three styles that are part of the Ngoko style tradition can – thus far – only be dated relative to these two groups (Seidensticker 2016, 121–123 Fig. 6.5): the Pandama style (Seidensticker 2021, 155–158) shows considerable similarities with the modern Mbenja pottery, the Quesso style (Seidensticker 2021, 152–155) shows similarities to the Pandama style, and the Konda group (Seidensticker 2021, 148–152) shows similarities to the styles Mandombe and Pandama respectively. The proposed order of these pottery styles starts in the 13th to 15th century CE with the Mandombe style, followed by the Konda group and the Quesso group, which in turn are surpassed by the Pandama style, which links to the modern Mbenja pottery.

All styles within the Ngoko style tradition share similar main vessel types: pots with convex bellies, concave necks, and short, everted rims. While decorations in the Mandombe style are based on grooves, often using a comb, and comb impressions, the lower halves of the vessels are consistently roughed up by a slurry or slip (Fig. 7.1–3). A diagnostic property are plastic decorations, such as knobs and ledges, that can only be found among vessels of the Mandombe style. While relying on grooves and impressions, the succeeding Konda style shows no plastic decorations (Fig. 7.4–5). The Quesso pottery shows decorations made through grooving and comb impressions, similar to the Konda pottery (Fig. 7.6–7). At the same time, the shape of the rims is similar to the Pandama style. The decorations of Pandama pottery are based on knotted strip, twisted string, and alternate knotted strip roulettes, which are sometimes superimposed by grooves (Fig. 7.8–9). Roulette decoration was previously observed only in some vessel units associated with the styles Mandombe and Konda. This indicates a slow and staged introduction of roulette within the developed system of the Ngoko style tradition (Seidensticker 2016, 120–123). Within the modern Mbenja style, vessel shapes become more heterogeneous, while the shape of the rims persist. Concerning decorations, Mbenja pottery shows carved roulette only and decor is restricted to a single band on the vessel shoulders (Fig. 7.10). None of the ceramics associated with the Ngoko style tradition show fabrics indicative of the usage of fine riverine clays (Seidensticker 2020). Sherds contain substantial quantities of quartz and organic temper. Pottery of the Mandombe style excavated at Pikunda, and modern pottery produced in Pikunda in 1987, decorated with knotted strip roulette, was produced using coiling. All these styles show inherent commonalities and, at the same time, substantial differences to any pottery linked to the Equator-Co style tradition of the Inner Congo Basin (Wotzka 1995). The fieldwork of the *River Reconnaissance Project* in 1987 only uncovered the southern margins of the Ngoko tradition, which reached as far south as Pikunda on the middle Sangha river (Fig. 6C–F). Its upstream or northern extent can only be revealed during future fieldwork in the south-east of Cameroon and the south-west of the Central Africa Republic respectively.

586 Late Iron Age (1000–1850 CE) in the Northern Congo Basin

587 During the younger part of the pottery sequence in the northern Congo Basin the
588 three-way split of regional ceramic development persists (Fig. 8): on the lower part
589 of the river, up to 180 to 240 km upstream, all observed ceramics are part of the
590 Equator-Co tradition of the Inner Congo Basin. Inventories from sites in that region
591 are dominated by the newly described Bokwango style and the already established
592 styles Bondongo, Mbandaka, and Botendo (Seidensticker 2021, 96–98, 172–181). The
593 area further upstream, up to Bangui, showed a complex set of pottery styles described
594 below. Upstream of Bangui, only very young pottery has been identified as of yet.
595 A key characteristic of the pottery styles pertaining to the Late Iron Age along the
596 Ubangi river is the introduction of roulette decoration in an equally staged and slow
597 process as in the Ngoko style tradition.

598 While excavations in this area are rare, only pits with Batalimo-Maluba pottery at
599 Maluba were sufficiently excavated during the *River Reconnaissance Project*, there are
600 no adequately documented inventories known thus far that yielded pottery dating into
601 the Late Iron Age. Therefore, all lines of reasoning are based on stylistic developments
602 within survey inventories. Modern pottery production documented at four sites on the
603 middle and upper Ubangi river are the only points of reference.

604 At Mbati-Ngombe on the middle Ubangi river, the production of short-necked
605 vessels and bowls with round bases (Fig. 5.21–22) shaped via coiling was observed
606 (Seidensticker 2021, 109–121). Bowls show inverted rims, while the vessels usually
607 have a short cylindrical neck and very short, everted rim. Most distinctive is the
608 systematic decoration of vessels of the Mbati-Ngombe group using either knotted
609 strip, twisted string, or alternated knotted strip roulettes (Livingstone Smith et al.
610 2010, 88–105) in a single band below the rim or occasionally on the inside of the rim.

611 Further upstream, ceramic vessels were produced at Dama 1, Sidi and Boduna by
612 means of pounding in a concave mold (Seidensticker 2021, 69 Ftn. 101). Dama style
613 pottery (Seidensticker 2021, 104–109) consists of either smaller pots with rounded
614 bases and short everted rims but without a defined neck area or substantially bigger
615 vessels with pronounced convex shoulders and everted rims (Fig. 5.19–20). The pri-
616 mary means of decoration within the Dama style are carved roulettes, consistently
617 applied in a single band on the vessel's shoulder. Only rarely is the roulette accompa-
618 nied by grooves or impressions.

619 The Kpetene style summarizes a set of ethnographic vessels whose production was
620 not documented. This style is comprised of ovaloid vessels and bowls with round bases
621 that are extravagantly decorated with multiple bands of carved roulette (Seidensticker
622 2021, 103–105). Near Bangui, modern vessels with flat bases and a decoration not
623 relying on roulettes are observed (Seidensticker 2021, 112–114). This group, named
624 after the capital of the Central African Republic, shows systematic roughing up of the
625 lower parts of the vessels with *banfwa-nfwa*. In contrast, the upper parts are decorated
626 with multiple bands of impressions and grooves (Fig. 5.24).

627 The most distinctive style among the precursors of these modern productions is the
628 Motenge-Boma group (Seidensticker 2021, 99–103), first discovered by Van Noten
629 (1977, 75, 1982b, 69, Fig. 40). The vessels of the Motenge-Boma group show convex
630 bellies, no pronounced neck areas and, most importantly, a particular variety of rim

631 shapes (Fig. 5.10–13). Often, the usually straight or slightly inverted rims show thick
632 ledges. The spectrum of vessel shapes within the Motenge-Boma group also includes
633 convex bows with thickened rims. A clear marker of the Motenge-Boma pottery is
634 a decoration based on bands of carved or, in some cases, knotted strip roulette in
635 combination with grooves and impressions on the bellies and shoulders of vessels.
636 The rims are often also decorated similarly. No new pointers for the dating of the
637 Motengo-Boma pottery have been obtained as studied ceramics of this style were
638 found entirely as surface finds. Thus, until excavations uncover inventories pertaining
639 to this style as well as datable material, the age of the Motenge-Boma pottery can only
640 be estimated to be somewhere in the second half of 2nd millennium CE as suggested by
641 Van Note (1982b, 69). The detailed surveys of 1985 could demarcate the distribution
642 of this pottery along the Ubangi river quite well. Motenge-Boma ceramics are only
643 found from the mouth of the Lua river in the south to Bangui in the north (Fig. 6D–E;
644 Seidensticker 2021, 102 Fig. 37).

645 Evidence for pottery dating between the end of the Batalimo-Maluba style in the
646 6th century CE (Fig. S1; Tab. S1) and the onset of the Motenge-Boma group is scarce.
647 The provisional styles Dongo, Mokelo and Bobulu (Fig. 2; Seidensticker 2021, 86–95)
648 are noteworthy as they date potentially between the mid of the 1st millennium CE
649 and the middle of the 2nd millennium CE. The most diagnostic among these is the
650 Mokelo pottery, distributed between the mouth of the Lua river and the bend of the
651 Ubangi river further upstream. Its vessels often show tapered profiles (Fig. 5.8–9).
652 While carved roulette decoration is occasionally present, the bulk of its decors is
653 achieved utilizing incisions and bands of comb impressions.

654 Notably, no ceramics dating to before the 10th century CE were found along the
655 lower stretches of the Ubangi river, south of Impfondo. All finds from that region
656 pertain to pottery styles known from the Inner Congo Basin, such as Bondongo,
657 Mbandaka, and Botendo (Fig. 5.14–16,25; Seidensticker 2021, 172–181), with the
658 only exception being the newly described Bokwango style (Fig. 5.17–18; Seidensticker
659 2021, 96–99). The ceramics of this group are an off-shoot for the Equator-Co style
660 tradition (Wotzka 1995). The lower halves of Bokwango vessels are decorated with
661 *banfwa-nfwa*, as is typical for styles from the Inner Congo Basin dating into the Late
662 Iron Age but showing slightly tapered profiles.

663 Discussion

664 Settlement History of the Congo Basin

665 The results from the northern and western parts of the Congo Basin presented here
666 complement the available data on the settlement history of the Inner (Wotzka 1995)
667 and north-eastern Congo Basin (Livingstone Smith et al. 2017), enabling a synopsis
668 of the settlement history of the region as a whole (Seidensticker 2021, 218–244). The
669 earliest pottery group known within the entire Congo Basin thus far is the Imbonga
670 style, dating into the 4th to 2nd century BCE (Fig. 2; S1; Tab. S1) that is found within
671 the western half of the *Cuvette centrale* (Fig. 4A; Wotzka 1995, 59–68) as well as at
672 two sites along the lower Sangha river.

673 The Imbonga style differentiates into multiple groups that still inherit substantial
674 morphological and decoration characteristics in the following phase, starting in the 3rd
675 and 2nd century BCE (Seidensticker 2021, 219–224). Initially, the later individually
676 described styles Bonkake, Ingende and Inganda (Fig. 2; S1; Tab. S1; Wotzka 1995,
677 68–84) were conceptualized as part of a broader ‘Imbonga horizon’ (Eggert 1983).
678 During this time, the settled area in the Inner Congo Basin slightly expanded upriver
679 along the lower Tshuapa, up to the region of the modern town of Boende, and on
680 the lower Luilaka (Fig. S2B). The development of ceramic styles in the Inner Congo
681 Basin around the turn of time is characterized by differentiation and regionalization,
682 with many of the successors of the Imbonga style being only distributed along certain
683 tributaries of the Congo river.

684 Also within this time period, the initial phase of pottery-producing communities
685 emerged in the north-eastern parts of the Basin, in the vicinity of Kisangani (Fig. S2A;
686 Livingstone Smith et al. 2017). The pottery of the Early Phase dates between the 2nd
687 century BCE and 1st century CE (Fig. 2; S1; Tab. S1). Livingstone Smith et al.
688 (2017, 110,115) propose a relation of this pottery to the contemporaneous Imbonga
689 style of the Inner Congo Basin, especially regarding the use of similar decorative
690 techniques. In a critical review it must be noted that the pottery of the Early Phase
691 (Livingstone Smith et al. 2017, 112 Fig. 24) lacks systematic rocker zig-zag on the
692 bottom parts of vessels as well as plastic decorations such as ledges or ridges, and
693 vessels shows no pronounced shoulders, all primary characteristics of the Imbonga
694 style (Seidensticker 2021, 170 Fig. 84.1–20). Pottery of the Early Phase is still attested
695 until the 1st century CE, while the Middle Phase pottery already commences (Fig. 2;
696 S1; Tab. S1; Livingstone Smith et al. 2017).

697 In the 2nd to 1st century BCE pottery-producing communities emerge in the
698 western and northern Congo Basin: along the Sangha and Likwala-aux-Herbes rivers,
699 the Pikunda-Munda style and along the middle Ubangi river, on the northern fringes
700 of the rainforest, the Batalimo-Maluba (Fig. 2; S1; Tab. S1) and the Ngbanja styles
701 can be found (Fig. 4B). It is essential to state that these groups share no fundamental
702 commonalities with the pottery of the Inner Congo Basin and must be regarded as
703 distinct and individual lines of development. Based on preliminary technological
704 analyses, a connection to the Inner Congo Basin’s contemporaneous ceramics can
705 only be postulated for the Pikunda-Munda group. Ceramics within the western and
706 Inner Congo Basin appear to have been shaped in either a drawing of a lump or a
707 ring technique. These ceramics have yet to be differentiated, especially regarding used
708 clays and the lack of tempering of the clays (Seidensticker 2020).

709 The first half of the 1st millennium CE sees a continuation of the described
710 patterns. In the Inner Congo Basin, multiple interrelated styles with only regional
711 distribution areas emerge (Fig. S2C–D). It should be noted that during this time,
712 a slight retreat of settlement activity is discernible, with substantially fewer sites
713 compared to the centuries BCE being known along the Lulonga and Lopori rivers
714 (Seidensticker 2021, 224). This apparent plateauing of settlement activity has been
715 interpreted as a harbinger of the setback in human activity visible throughout Central
716 Africa that continued until the 10th century CE (Seidensticker et al. 2021).

717 Within the entire Congo Basin, only very few dated sites point to the presence of
718 pottery-producing communities between the 7th to 10th centuries CE (Seidensticker

719 2021, 225–231; Seidensticker et al. 2021, Fig. S4). The two predominant styles in the
720 western and northern Congo Basin, the Pikunda-Munda and Batalimo-Maluba, ended
721 between the 4th to 6th century CE at the latest (Fig. S1; Tab. S1). The available dates
722 for the Middle Phase pottery in the Kisangani region indicate that it ended around
723 the same time. The earliest evidence for the Ilambi style, clearly pertaining to the
724 younger Iron Age, dates to the 8th century CE. It must be stressed that this early
725 date is challenged by another date also associated with Ilambi pottery, dating into the
726 15th to 17th century CE, leaving a considerable discrepancy (Livingstone Smith et al.
727 2017, 98 Tab. 1).

728 Substantial human activity is attested for again by significant increases in sites
729 yielding pottery dating to the 11th century CE and younger. Among these are the
730 widely distributed styles Bondongo and Longa (Fig. 2; S1; Tab. S1; Wotzka 1995,
731 121–139). While these groups are distributed across nearly all parts of the Inner
732 Congo Basin that was surveyed during the *River Reconnaissance Project*, and in the
733 case of the Bondongo group also along the lower Ubangi river, they are immediately
734 followed by a distinct development of regional traditions (Wotzka 1995 221–223;
735 Seidensticker 2021, 231–244; Seidensticker et al. 2021, 3–5). Along the lower Sangha
736 river, the newly dated Ngombe group (Tab. 2) reflects an uptick in human activity.
737 Starting in the 13th century CE, new components of pottery production commence
738 along the Ngoko river and upstream parts at the Sangha river. These new elements form
739 the foundation for the newly described Ngoko style tradition, whose onset is marked
740 by the emergence of the Mandombe style. This group is later followed by at least three
741 more pottery styles that lead directly into the modern potters' production in the area.
742 Along the Likwala-aux-Herbes river, re-settlement is only attested for starting in the
743 16th century CE, documented by newly obtained radiocarbon dates for ceramics of the
744 Ebambe style (Tab. 2: RICH-30866). Within a similar time falls the Motenge-Boma
745 style found along the middle Ubangi river. It is putatively preceded by the poorly
746 attested Dongo, Mokelo, and Bobulu groups. The introduction of roulette decoration
747 within the Ngoko style tradition, as well as among the groups on the middle Ubangi
748 river, while being an easily observable marker, cannot be described as a watershed
749 event but rather a process of slow adaption (Seidensticker 2016, 120–123). Similarly
750 to these regions, roulette decoration becomes a prime marker of younger pottery styles
751 in the Kisangani region (Livingstone Smith et al. 2017).

752 Refuting the "Sangha River Interval" (SRI) Hypothesis

753 The putative origin of ceramic-producing communities starting to settle in the Congo
754 Basin in the 4th century BCE remains elusive. Linguistic studies propose rapid migra-
755 tions through the rainforest (Currie et al. 2013; Whiteley et al. 2019; Koile et al. 2022)
756 and suggest that the region of the Sangha river, in the western Congo Basin (Fig. 1),
757 played a crucial role as a potential 'gateway' through the equatorial rainforest of the
758 Congo Basin (Grollemund et al. 2015; Bostoen et al. 2015; Grollemund et al. 2023).
759 In consequence, putative Bantu-speaking migrants are deemed to have followed a
760 savannah-corridor, determined by the Sangha River Interval (SRI), in the latter half
761 of the 1st millennium BCE (Grollemund et al. 2015; Bostoen et al. 2015). This hy-

762 pothesis is brought forward based on statistical analyses of present-day languages and
763 attempts to integrate archaeological data into the outcome of these statistical analyses
764 against the background of an ecologically identified "forest perturbation" (Bostoen
765 et al. 2015, 356) during the Late Holocene Rainforests Crisis (LHRC) (Vincens et al.
766 1994; Elenga et al. 1996; Raynaud-Farrera et al. 1996; Maley and Brenac 1998; Vin-
767 cens et al. 1998; Maley 2004; Ngomanda et al. 2009; Sangen 2009; Giresse et al.
768 2020).

769 The unique composition of the region along the Sangha river (cf. "W & E mar-
770 gins" in Philippon et al. 2019, 7 Fig. 3A), linking plant and animal species from
771 the Sudanian and Zambezian savannas, was first brought forward in René Letouzey
772 (1968). This roughly 400 km wide region between 14 and 18°E "lacks some plant
773 species typical of dense humid forests present in both the lower Guinean and the
774 Congolian floristic domains in Cameroon-Gabon and the Democratic Republic of the
775 Congo, respectively" (Bostoen et al. 2015, 356). Remote sensing data corroborate the
776 specific ecology of the SRI (Gond et al. 2013; Philippon et al. 2019). Ground truths
777 for a widespread opening of the forest are severely lacking, especially those for the 1st
778 millennium BCE during which such an opening is regarded as triggering for a south-
779 wards migrations of Bantu-speech communities (Grollemund et al. 2015; Bostoen
780 et al. 2015). The existence of the SRI during the 1st millennium BCE was recently
781 critically reviewed based on a multi-proxy analysis, combining phytolith assemblages
782 with $\delta^{13}\text{C}$ rations of the soil organic carbon from soil profiles within the SRI (Bremond
783 et al. 2017). Out of all 18 profiles, only four showed $\delta^{13}\text{C}$ values higher than -25‰
784 and can be related to past vegetation changes during the 1st millennium BCE. The
785 phytolith assemblages further corroborate these findings of only occasional and rare
786 forest openings (Bremond et al. 2017, 99). Following Bremond et al. (2017), (Giresse
787 et al. 2020, 1) concluded "the increase of settlements [in Central Africa] clearly began
788 after 2350 yr BP, not before 2500 BP" and "the SRI [then being] mainly composed
789 of pioneer taxa and open canopy forest formations with low densities of large trees"
790 (Giresse et al. 2020, 11) with the savannas of the interval having disappeared. During
791 the last millennium, the environment in the SRI shows considerable stability (Giresse
792 et al. 2023).

793 While Grollemund et al. (2015) and Bostoen et al. (2015) postulate large-scale
794 migrations of putative Bantu-speaking communities through the SRI, the compilation
795 of discussed sites in the Congo Basin by Bostoen et al. (2015, 356 Fig. 1) depicts
796 only the site of Imbonga on the Momboyo river. The entire settlement history of the
797 Inner Congo, which was published in detail (Eggert 1984, 1987; Wotzka 1995), has
798 been reduced to the putative and untested connection between the earliest pottery
799 style (Imbonga) and the earliest immigration of Bantu speakers (Bostoen et al. 2015,
800 366). The fundamentals of the settlement history of the western Congo Basin (Eggert
801 1992, 1993) were largely omitted. Bostoen et al. (2015, 364) reduce these reports
802 to a short note concerning the association of evidence for iron metallurgy with the
803 Pikunda-Munda pottery style. A review of the radiocarbon dates, which were already
804 published by Eggert (1992, 1993), shows an at least 200-year off-set between the oldest
805 dates in the heart of the rainforest (Imbonga) versus the oldest dates from within the
806 SRI (Pikunda-Munda; Fig. S1; Tab. S1). Thus, archaeological fieldwork in the western
807 Congo Basin, and the SRI in particular, have not revealed any precursors of the oldest

808 pottery of the Congo Basin, whose distribution is relegated to the western half of the
809 Inner Congo Basin (Seidensticker 2021, 220 Fig. 100A). Based on evidence brought
810 forward by Morin-Rivat et al. (2014), Seidensticker (2016), and Giresse et al. (2020),
811 Clist (2022) reverts the prior hypothesis by Bostoen et al. (2015) and concludes that
812 "large-scale movement [of people at the end of the 1st millennium BCE occurred]
813 mainly through the forest, and without using the SRI as it was stated a few years ago"
814 (Clist 2022, 67).

815 In conclusion, the SRI has to be considered a patchy opening of the dense forest
816 rather than a 'savannah corridor', and the fact that pottery-producing communities
817 settled within it at least 200 years after the western part of the Inner Congo Basin
818 was already settled dismisses the argumentation brought forward by Grollemund et al.
819 (2015, 2023) and Bostoen et al. (2015).

820 (Dis-)Continuities of pottery traditions in the Congo Basin

821 Of equal importance to the onset of the settlement of the Congo Basin by pottery-
822 producing communities is the persistence of these over the past 2400 years. Of special
823 importance in that respect is the proposed setback in human activity during the second
824 half of the 1st millennium CE (Seidensticker et al. 2021). Anecdotal evidence can
825 be derived from local and regional studies, such as the discontinuation of settlement
826 activities reported from central Gabon by Oslisly (1998, 101–103 Fig. 9, 2001, 112–
827 113 Fig. 7.9). At the island of Corsico (Equatorial Guinea), research found that the late
828 facies of the Oveng pottery, dating into the 7th to 8th century CE, coincides with "a
829 period of social and demographic decline that lasts until the late first millennium CE",
830 leading to "several centuries of depopulation" (Sánchez-Elipe et al. 2016, 355–356).
831 Also at Dibamba in western Cameroon, with six hectares the biggest site in the region
832 in terms of examined surface, showed a hiatus between the 4th to 10th century CE (de
833 Saulieu et al. 2017).

834 The sequence of pottery styles in the Inner Congo Basin has been described as
835 uninterrupted by Wotzka (1995). A detailed review of chronological indicators for the
836 32 pottery styles described by Wotzka (1995, 59–212) revealed that no pottery could
837 be securely dated between the end of the styles Bokuma and Lingonda, which come to
838 an end in the 7th centuries CE at the latest, and the onset of the widespread Bondongo
839 style at the beginning of 12th century CE (Fig. S1; Tab. S1; Seidensticker 2021,
840 193–204). Wotzka (1995, 121–128) proposed for the Longa style to be potentially
841 dated in-between the Early and Late Iron Age. Its characteristics show some links to
842 the styles Bokuma and Bokele, both dating into first half of the 1st millennium CE,
843 and strong links to the Bondongo style, dating between the 12th to 14th century CE
844 (Wotzka 1995, 127). One feature discussed in that regard is the onset of *banfwa-nfwa*
845 decoration during the times of the pottery styles Bokuma and Lingonda (Wotzka 1995,
846 109–111, 117–118). *Banfwa-nfwa* is restricted to the inside of the rims within those
847 styles. Vessels of the Longa style only rarely show *banfwa-nfwa* decoration, if so it is
848 mostly on the inside of the vessels and only very rarely on the outside (Wotzka 1995,
849 124). *Banfwa-nfwa* becomes the dominant decoration technique during the subsequent
850 Bondongo style, extensively covering the outside of vessels (Wotzka 1995, 131–134).

851 In consequence, the Longa style is regarded by Wotzka (1995, 125–128) as a 'bracket',
852 connecting better dated pottery styles from the end of the Early Iron Age and the onset
853 of the Late Iron Age.

854 None of the three radiocarbon dates associated with Longa pottery date into the
855 time-span between the 6th to 10th century CE though. Two somewhat older dates
856 (Hv-12611, Hv-12626) are discarded by Wotzka (1995, 127–128 Tab. 53) as not-
857 representative. The third available date (Hv-11572) covers the 11th to 14th century
858 CE. This last date goes very well with the close stylistic connections Longa pottery
859 shows to the Bondongo style, which is firmly dated between the beginning of the 12th
860 and the end of the 14th century CE (Fig. 2; S1; Tab. S1; Wotzka 1995, 138 Tab. 58).
861 This younger date for the Longa pottery is further supported by a new radiocarbon
862 date obtained from a food crust on the bottom of the enormous globular vessel found
863 at Ngombe on the middle Sangha river (Tab. 2: RICH-30867). The ceramics found
864 within this feature are the basis of the pottery style of the same name, which shows
865 strong similarities with the Longa style. This gives enough reason to propose the age
866 of the Longa style to be later than the 10th century CE, thus dating it firmly to the
867 Late Iron Age. This reassessment of the chronology of the Longa pottery leaves the
868 same 'gap' or 'hiatus' within the sequence of the Inner Congo Basin that has been
869 observed in several locations of Central Africa (de Saulieu et al. 2021; Seidensticker
870 et al. 2021). Consequently, the conceptualization of an uninterrupted sequence of
871 pottery styles starting with the Imbonga style and leading, similar to a network of
872 direct decedents, right to the local potters' producing ceramic today (Wotzka 1995,
873 65, 221, 274, 285) must be questioned.

874 Two recent papers firmly established a supra-regional pattern of putative demo-
875 graphic changes in Central Africa during the past three millennia, both showing strong
876 empirical evidence for a setback in human activity between the 6th to 10th century CE
877 (de Saulieu et al. 2021; Seidensticker et al. 2021). Clist et al. (2023) aim at critically
878 reviewing these independent results by listing regional research biases and urging for
879 more fieldwork. The arguments brought forward by Clist et al. (2023) are unfortu-
880 nately based on interpreting uncalibrated radiocarbon dates, neglecting the effort by
881 Seidensticker et al. (2021, 9, Tab. S1) in classifying the available radiocarbon dates
882 following tested principles of 'chronometric hygiene' (Spriggs 1989; Spriggs and
883 Anderson 1993; Pettitt et al. 2003; Napolitano et al. 2019), and lack formal testing of
884 the proposed biases (cf. Galletti et al. 2013; Gillespie et al. 2016; Jones et al. 2019;
885 Alwi Muttaqin et al. 2019; Boemke et al. 2023).

886 Fuzzy Border at the Ubangi river

887 Another intriguing aspect concerns the importance of the surveyed river systems.
888 Particular focus is always laid on whether rivers constitute exchange barriers or,
889 instead, that they are preferred pathways for expansion and axes of contact (Russell
890 et al. 2014). The observed distribution patterns of pottery styles along the Ubangi
891 river, a consecutive 850 km long north–south transect, show a seemingly impermeable
892 border zone that existed for nearly two millennia (Fig. 8; Seidensticker 2021, 183–
893 185, 184 Tab. 17). This zone is persistent and long-lasting, with ceramics rarely found

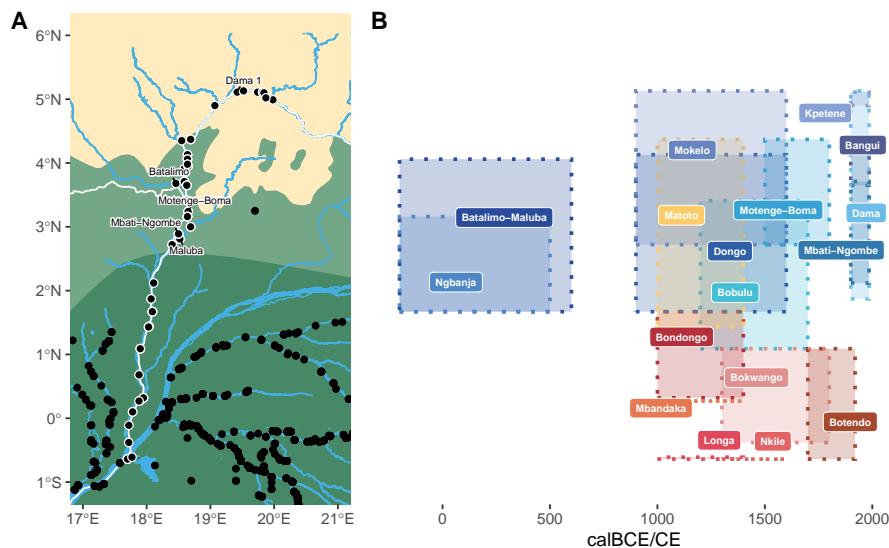


Fig. 8 Map of archaeological sites along the Ubangi river (left) and chronospatial distribution of pottery styles documented within the region (right). Sites along the Ubangi show a white border, while other archaeological sites are demarcated as simple black dots. The green shading denotes the putative rainforest distribution during the 1st millennium BCE (dark green; Bremond et al. 2017; Maley et al. 2017) and today (light green; White 1983).

894 outside their specific region. This 'fuzzy' boundary is situated between 1° to 1.5° N,
 895 north of Impfondo. South of this region, all ceramics date into the Late Iron Age and
 896 are all associated with the Equator-Co style tradition of the Inner Congo Basin (Wotzka
 897 1995). Further upriver, near the mouth of the Luá river, the Batalimo-Maluba style
 898 is among the earlier potteries in the region. All pottery groups that follow afterwards
 899 'respect' the southern border of the Batalimo-Maluba group (Fig. 8). This observation
 900 offers a unique view into a putative lack of social connectivity along one of the major
 901 rivers in Central Africa and needs more research.

902 Conclusions

903 While pottery styles identified in the northern parts of the study area follow indepen-
 904 dent trajectories, the styles of the western parts of the Congo Basin show substantial
 905 similarities to contemporaneous styles from the Inner Congo Basin. These similarities
 906 start with the clay sourcing, resulting in very similar macroscopic ceramic fabrics.
 907 Furthermore, while vessel shapes are sometimes different, decoration techniques and
 908 motives are nearly identical. Concerning the Pikunda-Munda style, the oldest pottery
 909 widely distributed in the western Congo Basin, strong technological similarities stand
 910 in the way of several stylistic differences. So far, this style can only be loosely asso-
 911 ciated with contemporaneous ceramics of the Inner Congo Basin. Furthermore, the
 912 Pikunda-Munda style did not develop into an individual stylistic tradition, and after
 913 its end, there are no reliable links with any younger styles in the region. More critical

for the settlement history of the Congo Basin is the fact that the emergence of the Pikunda-Munda group can only be dated as about 200–300 years younger than the emergence of the first pottery production further east, in the Inner Congo Basin. This fact, also considering that it is the earliest widely distributed pottery in the "Sangha River Interval" and shows legitimate stylistic differences to the ceramics from the Inner Congo Basin, refutes any hypotheses of migrations through the Congo Basin via the "Sangha River Interval" (Bostoen et al. 2015; Grollemund et al. 2015, 2023).

After a setback in human activity during the 7th to 10th centuries CE, pottery groups such as the Ngombe style appear that show close stylistic ties to pottery from the Equator Co-Tradition and can be regarded as part of them. The same general association as western offshoots of the Equator Co-Tradition goes for the younger styles Ebambe and Epena.

The introduction of roulette decorations, which often govern decoration practices of modern-day ceramics, is equally vital for the region's settlement history. A gradual adoption and intensive use of this ornamentation practice can be observed within the Ngoko tradition. In the extreme south of the study area, another distinct line of pottery development was observed within the grog-tempered Bobusa group.

The settlement sequence of the northern and western Congo Basin sketched out within this study must, at least in part, be taken cautiously due to the limited sources available. Only new fieldwork and excavations can remedy this situation. Thus far, the available data constitutes valid proof for the chrono-temporal position of the early parts of the sequence during the Early Iron Age. However, available data from the middle of the 1st millennium CE onwards must be considered incomplete. Despite the extensive body of material obtained by the *River Reconnaissance Project* in the 1980s, the present work only provides a first insight into the ceramic variability of the region.

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All data and computer code generated during this research is available here: https://github.com/dirkseidensticker/PikundaMunda_BatalimoMaluba_AAR.

References

- Alwi Muttaqin L, Heru Murti S, Susilo B (2019) MaxEnt (Maximum Entropy) model for predicting prehistoric cave sites in Karst area of Gunung Sewu, Gunung Kidul, Yogyakarta. In: Wibowo SB, Rimba AB, A Aziz A, Phinn S, Sri Sumantyo JT, Widyasamratri H, Arjasakusuma S (eds) Sixth Geoinformation Science Symposium, SPIE, Yogyakarta, Indonesia, p 3, DOI 10.1117/12.2543522
- Aumassip G (1975) La poterie de Batalimo. In: de Bayle des Hermens R (ed) Recherches préhistoriques en République Centrafricaine, Klincksieck, Paris, pp 221–234

- 959 Bahuchet S (1992) Dans la forêt d'Afrique Centrale: les Pygmées Aka et Baka. Ethnoscience 8; Histoire
960 d'une civilisation forestière 1, Peeters, Paris
- 961 Bequaert M (1937) Bijlen uit Neder-Congo, bijlen uit West-Oubangui en bijlen uit Uele. Bulletin des
962 séances de l'Institut Royal Colonial Belge 8(3):807–823
- 963 Bequaert M (1938) Matériel archéologique de l'Ubanghi. Bulletin de la Société royale Belge
964 d'Anthropologie et de Préhistoire 53:32–42
- 965 Bequaert M (1940) Haches de l'Oubanghi. Bulletin de la Société royale Belge d'Anthropologie et de
966 Préhistoire 55:110–113
- 967 Bequaert M (1946) Contribution à l'étude de la préhistoire de l'Oubangui. Bulletin de la Société Royale
968 Belge d'Anthropologie et de Préhistoire 57:182–187
- 969 Boemke B, Maier A, Schmidt I, Römer W, Lehmkühl F (2023) Testing the representativity of Palaeolithic
970 site distribution: The role of sampling bias in the European upper and Final Palaeolithic record.
971 Quaternary Science Reviews 316:108220, DOI 10.1016/j.quascirev.2023.108220
- 972 Bostoen K (2018) The Bantu Expansion. Oxford Research Encyclopedia of African History DOI 10.1093/
973 acref/9780190277734.013.191
- 974 Bostoen K (2020) The Bantu Expansion: Some facts and fiction. In: Crevels EI, Muysken P (eds) Language
975 Dispersal, Diversification, and Contact: A Global Perspective, Oxford University Press, pp 227–239,
976 DOI 10.1093/oso/9780198723813.003.0013
- 977 Bostoen K, Gunnink H (2022) The Impact of Autochthonous Languages on Bantu Language Variation: A
978 Comparative View on Southern and Central Africa. In: Mufwene S, Escobar AM (eds) The Cambridge
979 Handbook of Language Contact: Volume 1: Population Movement and Language Change, Cambridge
980 Handbooks in Language and Linguistics, Cambridge University Press, pp 152–186
- 981 Bostoen K, Clist B, Doumenge C, Grollemund R, Homber JM, Muluwa JK, Maley J (2015) Middle to
982 Late Holocene Paleoclimatic Change and the Early Bantu Expansion in the Rain Forests of Western
983 Central Africa. Current Anthropology 56(3):354–384, DOI 10.1086/681436
- 984 Bremond L, Bodin SC, Bentaleb I, Favier C, Canal S (2017) Past tree cover of the Congo Basin recovered
985 by phytoliths and $d_{13}\text{C}$ along soil profiles. Quaternary International 434:91–101, DOI 10.1016/j.
986 quaint.2015.11.150
- 987 Clist B (2004) Des premiers villages aux premiers Européens autour de l'Estuaire du Gabon. Quatre
988 millénaires d'interactions entre l'homme et son milieu. Unpubl. Ph.D. Dissertation. Université Libre
989 de Bruxelles, Academic Year 2004–2005. Université Libre de Bruxelles, Brussels
- 990 Clist B (2022) West-Central African Diversity from the Stone Age to the Iron Age, Continuities and
991 Transitions during the Late Pleistocene and the Holocene. In: Fortes-Lima C, Mtetwa E, Schlebusch C
992 (eds) Africa, the Cradle of Human Diversity: Cultural and Biological Approaches to Uncover African
993 Diversity, no. volume 26 in Africa-Europe Group for Interdisciplinary Studies, Brill, Leiden ; Boston,
994 pp 63–110
- 995 Clist B, Denbow J, Lanfranchi R (2023) Using the radiocarbon dates of Central Africa for studying
996 long-term demographic trends of the last 50,000 years: Potential and pitfalls. Azania: Archaeological
997 Research in Africa 58(2):93, DOI 10.1080/0067270X.2023.2215649
- 998 Cornelissen E, Ebosso Lihunzu O, Mambo Nsangathi C (2013) Prospections sur la Lindi (Province Orientale,
999 République démocratique du Congo). Nyame Akuma 79:74–82
- 1000 Crema ER, Di Napoli R (2021) nimbleCarbon: Bayesian Analyses of Radiocarbon Dates with NIMBLE
- 1001 Crema ER, Kobayashi K (2020) A multi-proxy inference of Jōmon population dynamics using bayesian
1002 phase models, residential data, and summed probability distribution of ^{14}C dates. Journal of Archaeo-
1003 logical Science 117:105136, DOI 10.1016/j.jas.2020.105136
- 1004 Crema ER, Shoda S (2021) A Bayesian approach for fitting and comparing demographic growth models
1005 of radiocarbon dates: A case study on the Jomon-Yayoi transition in Kyushu (Japan). PLOS ONE
1006 16(5):e0251695, DOI 10.1371/journal.pone.0251695
- 1007 Currie TE, Meade A, Guillou M, Mace R (2013) Cultural phylogeography of the Bantu Languages of
1008 sub-Saharan Africa. Proceedings of the Royal Society B: Biological Sciences 280(1762):20130695,
1009 DOI 10.1098/rspb.2013.0695
- 1010 de Bayle des Hermens R (1969) Résultats d'ensemble des missions de recherches préhistoriques effectuée
1011 en 1966, 1967 et 1968 en République Centrafricaine. Bull Soc roy belge Anthropréhist 80:5–20
- 1012 de Bayle des Hermens R (1971) Quelques aspects de la Préhistoire en République Centrafricaine. The
1013 Journal of African History 12(4):579–597, DOI 10.1017/S0021853700011178
- 1014 de Bayle des Hermens R (1975) Recherches préhistoriques en République Centrafricaine. Klincksieck,
1015 Paris

- 1016 de Maret P (1986) The Ngovo Group: An industry with polished stone tools and pottery in Lower Zaïre. African Archaeological Review 4:103–133
- 1017 de Maret P (1989) Le contexte archéologique de l'expansion Bantu en Afrique Centrale. In: Obenga T (ed) Les Peuples bantu: migrations, expansion et identité culturelle: actes du colloque international, Libreville 1-6 avril 1985, CICIBA ; L'Harmattan, Libreville : Paris, pp 118–138
- 1018 de Saulieu G, Oslisly R, Nlend Nlend P, Ngouhou F (2017) Deux mille cinq cents ans de traditions céramiques à Dibamba Yassa (Cameroun). Afrique: Archéologie & Arts 13:23–40, DOI 10.4000/aaa.979
- 1019 de Saulieu G, Garcin Y, Sebag D, Nlend PRN, Zeitlyn D, Deschamps P, Ménot G, Carlo PD, Oslisly R (2021) Archaeological Evidence for Population Rise and Collapse between ~2500 and ~500 cal. yr BP in Western Central Africa. Afrique : Archeologie et Arts 17:11–32, DOI 10.4000/aaa.3029
- 1020 Eggert MKH (1980) Der Keramikfund von Bondongo-Losombo (Région de l'Equateur, Zaïre) und die Archäologie des äquatorialen Regenwaldes. Beiträge zur Allgemeinen und Vergleichenden Archäologie 2:381–427
- 1021 Eggert MKH (1983) Remarks on Exploring Archaeologically Unknown Rain Forest Territory. The Case of Central Africa. Beiträge zur Allgemeinen und Vergleichenden Archäologie 5:283–322
- 1022 Eggert MKH (1984) Imbonga und Lingonda: Zur frühesten Besiedlung des zentralafrikanischen Regenwaldes. Beiträge zur Allgemeinen und Vergleichenden Archäologie 6:247–288
- 1023 Eggert MKH (1987) Imbonga and Batalimo: Ceramic evidence for early settlement of the equatorial rain forest. African Archaeological Review 5:129–145, DOI 10.1007/BF01117088
- 1024 Eggert MKH (1988) Archäologie und Keramik-Ethnographie im äquatorialen Regenwald Zaires. In: Vossen R (ed) Töpfereiforschung zwischen Archäologie und Entwicklungspolitik, Töpferei- und Keramikforschung, Habelt, Bonn, pp 25–38
- 1025 Eggert MKH (1992) The Central African Rain Forest: Historical Speculation and Archaeological Facts. World Archaeology 24:1–24, DOI 10.1080/00438243.1992.9980190
- 1026 Eggert MKH (1993) Central Africa and the Archaeology of the Equatorial Rainforest. Reflections on Some Major Topics. In: Shaw T, Sinclair P, Andah B, Okpoko A (eds) The Archaeology of Africa. Food, Metal and Towns, One World Archaeology, Routledge, London and New York, pp 289–329
- 1027 Eggert MKH (1996) Pots, Farming and Analogy: Early Ceramics in the Equatorial Rainforest. Azania: Archaeological Research in Africa 29/30:332–338
- 1028 Eggert MKH (2005) The Bantu Problem and African Archaeology. In: Stahl AB (ed) African Archaeology, Blackwell Studies in Global Archaeology, Blackwell Pub., Malden, pp 301–326
- 1029 Eggert MKH (2016) Geneticizing Bantu: Historical Insight or Historical Trilemma? Medieval Worlds 4:79–90, DOI 10.1553/medievalworlds_no4_2016s79
- 1030 Eggert MKH (2017) Case Study: Rainforst. In: Livingstone-Smith A, Cornelissen E, Gosselain OP, MacEachern S (eds) Field Manual for African Archaeology. Documents on Social Sciences and Humanities, Royal Museum for Central Africa, Tervuren, pp 60–64
- 1031 Eggert MKH (in prep.) Pottery Making in Ikenge on the Ruki and Other Villages in the Congo Basin. Edition Historische Kulturwissenschaften, Waxmann, Münster and New York
- 1032 Eggert MKH, Kanimba-Misago (1980) Aspects d'un métier traditionnel: L'industrie de poterie à Ikenge (Région de l'Equateur, Zaïre). Baesseler-Archiv NF 28:387–430
- 1033 Ehret C (1973) Patterns of Bantu and Central Sudanic Settlement in Central and Southern Africa (ca. 1000 B.C.–500 A.D.). Transafrican Journal of History 3:1–71
- 1034 Elenga H, Schwartz D, Vincens A, Bertaux J, de Namur C, Martin L, Wirrmann D, Servant M (1996) Diagramme pollinique holocène du lac Kitina (Congo): Mise en évidence de changements paléobotaniques et paléoclimatiques dans le massif forestier du Mayombe. Comptes Rendus de l'Académie des Sciences Série 2a : Sciences de la Terre et des Planètes 323:403–410
- 1035 Galletti CS, Ridder E, Falconer SE, Fall PL (2013) Maxent modeling of ancient and modern agricultural terraces in the Troodos foothills, Cyprus. Applied Geography 39:46–56, DOI 10.1016/j.apgeog.2012.11.020
- 1036 Gillespie TW, Smith ML, Barron S, Kalra K, Rovzar C (2016) Predictive Modelling for Archaeological Sites: Ashokan Edicts from the Indian Subcontinent. Current Science 110(10):1916, DOI 10.18520/cs/v110/i10/1916-1921
- 1037 Gillet JF (2013) Les forêts à Marantaceae au sein de la mosaïque forestière du Nord de la République du Congo: Origines et modalités de gestion. PhD thesis, Université de Liège, Liège
- 1038 Giresse P, Maley J, Chepstow-Lusty A (2020) Understanding the 2500 yr BP rainforest crisis in West and Central Africa in the framework of the Late Holocene: Pluridisciplinary analysis and multi-archive reconstruction. Global and Planetary Change 192(se):103257, DOI 10.1016/j.gloplacha.2020.103257

- 1073 Giresse P, Maley J, Chepstow-Lusty A (2023) A focus on the last 1000 years of natural environmental
1074 changes in the tropical rainforests of West and Central Africa. Can we detect anthropogenic distur-
1075 bances? *Global and Planetary Change* 220:103995, DOI 10.1016/j.gloplacha.2022.103995
- 1076 Gond V, Fayolle A, Pennec A, Cornu G, Mayaux P, Camberlin P, Doumenge C, Fauvet N, Gourlet-
1077 Fleury S (2013) Vegetation structure and greenness in Central Africa from Modis multi-temporal
1078 data. *Philosophical Transactions of the Royal Society B: Biological Sciences* 368(1625):1–8, DOI
1079 10.1098/rstb.2012.0309
- 1080 González-Ruibal A, Gelabert LP, Mañe AV (2011) Early Iron Age Burials from Equatorial Guinea: The
1081 Sites of Corisco Island. *Journal of African Archaeology* 9(1):41–66, DOI 10.3213/1612-1651-10182
- 1082 González-Ruibal A, Sánchez-Elipe M, Otero-Vilarín C (2012) An Ancient and Common Tradition: Funer-
1083 ary Rituals and Society in Equatorial Guinea (First–Twelfth Centuries AD). *African Archaeological
1084 Review* 30(2):115–143
- 1085 Grollemund R, Branford S, Bostoen K, Meade A, Venditti C, Pagel M (2015) Bantu expansion shows
1086 that habitat alters the route and pace of human dispersals. *Proceedings of the National Academy of
1087 Sciences of the United States of America* 112(43):13296–13301, DOI 10.1073/pnas.1503793112
- 1088 Grollemund R, Schoenbrun D, Vansina J (2023) Moving Histories: Bantu Language Expansions,
1089 Eclectic Economies, and Mobilities. *The Journal of African History* 64(1):13–37, DOI 10.1017/
1090 S0021853722000780
- 1091 Hall M (1983) Tribes, Traditions and Numbers: The American model in Southern African Iron Age Ceramic
1092 Studies. *The South African Archaeological Bulletin* 38:51–57
- 1093 Heine B, Hoff H, Vossen R (1977) Neuere Ergebnisse zur Territorialgeschichte der Bantu. In: Möhlig
1094 WJG, Rottland F, Heine B (eds) *Zur Sprachgeschichte und Ethnohistorie in Afrika: Neue Beiträge
1095 afrikanischer Forschungen*, Reimer, Berlin, pp 57–72
- 1096 Huffman TN (1970) The Early Iron Age and the Spread of the Bantu. *The South African Archaeological
1097 Bulletin* 25(97):3–21
- 1098 Jones PJ, Williamson GJ, Bowman DMJS, Lefroy EC (2019) Mapping Tasmania's cultural landscapes:
1099 Using habitat suitability modelling of archaeological sites as a landscape history tool. *Journal of
1100 Biogeography* 46(11):2570–2582, DOI 10.1111/jbi.13684
- 1101 Kiahtipes CA (2016) Late Holocene Paleoenvironments and Anthropogenic Impacts in the Ngotto Forest.
1102 PhD Dissertation. Southern Methodist University, Dallas
- 1103 Kiahtipes CA, Lupo K, Schmitt DN, Ndanga AJP, Jones JG, Lee R (2011) Prehistory and the present:
1104 Palaeoenvironments in the northern Congo Basin. *Before Faming* 2:1–14, DOI 10.3828/bfarm.2011.2.4
- 1105 Koile E, Greenhill SJ, Blasi DE, Bouckaert R, Gray RD (2022) Phylogeographic analysis of the Bantu
1106 language expansion supports a rainforest route. *Proceedings of the National Academy of Sciences
1107* 119(32):e2112853119, DOI 10.1073/pnas.2112853119
- 1108 Koté L (1992) Naissance et développement des économies de production en Afrique centrale: Formula-
1109 tion d'un modèle archéologique en terra incognita: Thèse présentée en vue du grade de docteur de
1110 l'université de Parix X. Université de Paris X, Nanterre, Paris
- 1111 Kroeber AL (1944) Archaeology in Peru in 1942, *Viking Fund Publications in Anthropology*, vol 4. The
1112 Viking Fund, New York
- 1113 Letouzey R (1968) Étude phytogéographique du Cameroun, *Encyclopédie Biologique*, vol 69. Édition Paul
1114 Lechevalier, Paris
- 1115 Lipson M, Sawchuk EA, Thompson JC, Oppenheimer J, Tryon CA, Ranhorn KL, de Luna KM, Sirak KA,
1116 Olalde I, Ambrose SH, Arthur JW, Arthur KJW, Ayodo G, Bertacchi A, Cerezo-Román JI, Culleton
1117 BJ, Curtis MC, Davis J, Gidna AO, Hanson A, Kaliba P, Katongo M, Kwekason A, Laird MF, Lewis
1118 J, Mabulla AZP, Mapemba F, Morris A, Mudenda G, Mwafulirwa R, Mwangomba D, Ndiema E,
1119 Ogola C, Schilt F, Willoughby PR, Wright DK, Zipkin A, Pinhasi R, Kennett DJ, Manthi FK, Rohland
1120 N, Patterson N, Reich D, Prendergast ME (2022) Ancient DNA and deep population structure in
1121 sub-Saharan African foragers. *Nature* 603:290–296, DOI 10.1038/s41586-022-04430-9
- 1122 Livingstone Smith A, Gosselain OP, Mayor A, Guèye S (2010) Modern roulettes in sub-Saharan Africa. In:
1123 Haour AC, Manning K, Arazi N, Gosselain OP, Guèye S, Keita D, Livingstone Smith A, MacDonald
1124 KC, Mayor A, McIntosh SK, Vernet R (eds) *African Pottery Roulettes Past and Present*, Oxbow,
1125 Oxford, pp 35–108
- 1126 Livingstone Smith A, Cornelissen E, Hubau W, Ebosso O (2011) Prospections et Fouilles Archéologiques
1127 de la Mission Boyekoli Ebale Congo 2010 (RDC). *Nyame Akuma* 75:11–16
- 1128 Livingstone Smith A, Cornelissen E, de Francq C, Nikis N, Mees F, Tshibamba Mukendi J, Beeckman
1129 H, Bourland N, Hubau W (2017) Forests and rivers: The archaeology of the north eastern Congo.
1130 *Quaternary International* 448:95–116, DOI 10.1016/j.quaint.2016.10.010

- 1131 Lupo KD, Schmitt DN, Kiahtipes CA, Ndanga JP, Young DC, Simiti B, Silva LC (2015) On Intensive
1132 Late Holocene Iron Mining and Production in the Northern Congo Basin and the Environmental
1133 Consequences Associated with Metallurgy in Central Africa. *PLoS ONE* 10(7):e0132632, DOI
1134 10.1371/journal.pone.0132632
- 1135 Lupo KD, Schmitt DN, Ndanga JP, Nguerede LP, Amaye GT, Smith AL, Edwards NM, Power RC,
1136 Craig Young D, Npo F (2021) Hunter-gatherers on the basin's edge: A preliminary look at Holocene
1137 human occupation of Nangara-Komba Shelter, Central African Republic. *Azania: Archaeological
1138 Research in Africa* 56(1):4–33, DOI 10.1080/0067270X.2020.1865636
- 1139 Maley J (2004) Les variations de la végétation et des paléoenvironnements du domaine forestier africain au
1140 cours de Quaternaire récent. In: Sémah AM, Renault-Miskovsky J (eds) *L'évolution de la végétation
1141 depuis deux millions d'années*, Paris, pp 143–178
- 1142 Maley J, Brenac P (1998) Vegetation dynamics, paleoenvironments and climatic changes in the forest
1143 of western Cameroon during the last 28,000 years B.P. *Review of Palaeobotany and Palynology*
1144 157:157–188
- 1145 Maley J, Doumenge C, Giresse P, Mahé G, Philippon N, Hubau W, Lokonda MO, Tshibamba JM, Chepstow-
1146 Lusty A (2017) Late Holocene forest contraction and fragmentation in central Africa. *Quaternary
1147 Research* 89(1):43–59, DOI 10.1017/qua.2017.97
- 1148 Morin-Rivat J (2017) Of trees and men: New insights into man-environment relationships in the moist
1149 forests of central Africa during the late Holocene. PhD thesis, Université de Liège & Gembloux
1150 Agro-Bio Tech, Liège
- 1151 Morin-Rivat J, Fayolle A, Gillet JF, Bourland N, Gourlet-Fleury S, Oslisly R, Bremond L, Bentaleb I,
1152 Beeckman H, Doucet JL (2014) New Evidence of Human Activities during the Holocene in the
1153 Lowland Forests of the Northern Congo Basin. *Radiocarbon* 56(1):209–220
- 1154 Mpika-Ngomla L (1996) Recherche comparée des céramiques traditionnelles du Congo, des origines à nos
1155 jours: Ethnoarchéologie: art traditionnel Bantu. Editions Action Culturelle, Brazzaville
- 1156 Napolitano MF, DiNapoli RJ, Stone JH, Levin MJ, Jew NP, Lane BG, O'Connor JT, Fitzpatrick SM
1157 (2019) Reevaluating human colonization of the Caribbean using chronometric hygiene and Bayesian
1158 modeling. *Science Advances* 5(12):eaar7806, DOI 10.1126/sciadv.aar7806
- 1159 Ndanga AJP, Cornelissen E, Lanfranchi R (2010) Quel lien entre les ateliers de taille de Ngo Tchororo
1160 et la céramique de Batalimo (RCA)? / Stone knappers at Ngo Tchororo and pottery makers at Batal-
1161 imo (CRA), did they meet? 13ème Congrès de la PANAF - 20ème Réunion de la SAFA. 1-7 Nov. 2010
1162 (Dakar)
- 1163 Neumann K, Eichhorn B, Wotzka HP (2022) Iron Age plant subsistence in the Inner Congo Basin (DR
1164 Congo). *Vegetation History and Archaeobotany* 31:481–509, DOI 10.1007/s00334-021-00865-8
- 1165 Ngomanda A, Neumann K, Schweizer A, Maley J (2009) Seasonality change and the third millennium
1166 BP rainforest crisis in southern Cameroon (Central Africa). *Quaternary Research* 71:307–318, DOI
1167 10.1016/j.yqres.2008.12.002
- 1168 Nurse D, Philipsson G (eds) (2003) *The Bantu Languages*. Routledge, London and New York
- 1169 Oliver R (1966) The Problem of the Bantu Expansion. *Journal of African History* 7(3):361–376
- 1170 Oslisly R (1998) Hommes et milieux à l'Holocene dans la moyenne vallée de l'Ogooué (Gabon). *Bulletin
1171 de la Société Préhistorique Française* 95(1):93–105
- 1172 Oslisly R (2001) The History of Human Settlement in the Middle Ogooué Valley (Gabon): Implications for
1173 the Environment. In: Weber W, White LJT, Vedder A, Naughton-Treves L (eds) *African Rain Forest
1174 Ecology and Conservation: An Interdisciplinary Perspective*, Yale University Press, New Haven, pp
1175 101–118
- 1176 Oslisly R, Bentaleb I, Favier C, Fontugne M, Gillet JF, Morin-Rivat J (2013) West Central African
1177 Peoples: Survey of Radiocarbon Dates over the Past 5000 Years. *Radiocarbon* 55(3):1377–1382,
1178 DOI 10.1017/S003382220004830X
- 1179 Pakendorf B, Bustoen K, de Filippo C (2011) Molecular Perspectives on the Bantu Expansion: A Synthesis.
1180 *Language Dynamics and Change* 1:50–88
- 1181 Peel MC, Finlayson BL, McMahon TA (2007) Updated World Map of the Köppen-Geiger Climate Classi-
1182 fication. *Hydrology and Earth System Science* 11(5):1633–2007, DOI 10.5194/hess-11-1633-2007
- 1183 Persits F, Ahlbrandt T, Tuttle M, Charpentier R, Brownfield ME, Takahashi K (1997) Maps showing
1184 geology, oil and gas fields and geological provinces of Africa Open-File Report 97-470-A. DOI
1185 10.3133/ofr97470A
- 1186 Pettitt P, Davies W, Gamble C, Richards M (2003) Palaeolithic radiocarbon chronology: Quantifying
1187 our confidence beyond two half-lives. *Journal of Archaeological Science* 30(12):1685–1693, DOI
1188 10.1016/S0305-4403(03)00070-0

- Philippon N, Cornu G, Monteil L, Gond V, Moron V, Pergaud J, Sèze G, Bigot S, Camberlin P, Doumenge C, Fayolle A, Ngomanda A (2019) The light-deficient climates of western Central African evergreen forests. *Environmental Research Letters* 14(3):034007, DOI 10.1088/1748-9326/aaf5d8
- Phillipson DW (1976a) Archaeology and Bantu Linguistics. *World Archaeology* 8(1):65–82
- Phillipson DW (1976b) The Early Iron Age in Eastern and Southern Africa: A Critical Re-appraisal. *Azania: Archaeological Research in Africa* 11(1):1–23
- Phillipson DW (1977) The Spread of the Bantu Languages. *Scientific American* 236(4):106–114
- Raynaud-Farrera I, Maley J, Wirrmann D (1996) Végétation et climat dans les forêts du Sud-Ouest Cameroun depuis 4770 ans B.P: Analyse pollinique des sédiments du Lac Ossa. *Comptes Rendus de l'Academie des Sciences, Series IIA, Earth and Planetary Science* 322:749–755
- Reimer PJ, Austin WEN, Bard E, Bayliss A, Blackwell PG, Bronk Ramsey C, Butzin M, Cheng H, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Hajdas I, Heaton TJ, Hogg AG, Hughen KA, Kromer B, Manning SW, Muscheler R, Palmer JG, Pearson C, van der Plicht J, Reimer RW, Richards DA, Scott EM, Southon JR, Turney CSM, Wacker L, Adolphi F, Büntgen U, Capano M, Fahrni SM, Fogtmann-Schulz A, Friedrich R, Köhler P, Kudsk S, Miyake F, Olsen J, Reinig F, Sakamoto M, Sookdeo A, Talamo S (2020) The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62(4):725–757, DOI 10.1017/RDC.2020.41
- Robertson JH, Bradley R (2000) A New Paradigm: The African Early Iron Age without Bantu Migrations. *History in Africa* 27:287, DOI 10.2307/3172118
- Rouse I (1957) Culture Area and Co-Tradition. *Southwestern Journal of Anthropology* 13(2):123–133
- Runge J (2001) Landschaftsgenese und Paläoklima in Zentralafrika: Physiogeographische Untersuchungen zur Landschaftsentwicklung und klimagesteuerten quartären Vegetations- und Geomorphodynamik in Kongo/Zaire (Kivu, Kasai, Oberkongo) und der Zentralafrikanischen Republik (Mbomou). *Borntraeger, Berlin*
- Russell T, Silva F, Steele J (2014) Modelling the Spread of Farming in the Bantu-Speaking Regions of Africa: An Archaeology-Based Phylogeography. *PLoS ONE* 9(1):1–9, DOI 10.1371/journal.pone.0087854
- Sánchez-Elipe M (2015) Las comunidades de la edad del hierro en África Centro-Occidental: Cultura Material e Identidad: Tesis Doctoral. *Universidad complutense de Madrid, Madrid*
- Sánchez-Elipe M, González-Ruibal A, Jordá Pardo JF, Marín Suárez C (2016) The Iron Age in West Central Africa: Radiocarbon Dates from Corisco Island (Equatorial Guinea). *The Journal of African History* 57(03):345–365, DOI 10.1017/S002185371600027X
- Sangen M (2009) Physiogeographische Untersuchungen zur pleistozänen und holozänen Umweltgeschichte an Alluvionen des Ntem-Binnendeltas und alluvialer Sedimente der Flüsse Boumba, Ngoko, Nyong und Sanaga in Süd-Kamerun. *Johann Wolfgang Goethe-Universität, Frankfurt am Main*
- Schmidt PR (1975) A new look at interpretations of the early Iron Age in East Africa. *History in Africa* 2:127–136
- Seidensticker D (2016) Archaeology and History in Iron Age Settlements in the Congo Basin. In: Sadr K, Esterhuysen A, Sievers C (eds) *African Archaeology Without Frontiers*, Wits University Press, Johannesburg, pp 114–126
- Seidensticker D (2020) Approaching Trans-Generational Training Networks in Central Africa: Using Ceramic Petrography to Retrace Provenance and Technology throughout Two Millennia. *Ceramic Petrology Group Meeting (CPG)*, 9-12 November 2020
- Seidensticker D (2021) Archäologische Untersuchungen zur eiszeitlichen Besiedlungsgeschichte des nordwestlichen Kongobeckens. *Tübingen University Press, Tübingen*
- Seidensticker D, Hubau W (2021) aDRAC (Archive des datations radiocarbones d'Afrique centrale). *Zenodo*, DOI 10.5281/ZENODO.4530717
- Seidensticker D, Hubau W, Verschuren D, Fortes-Lima C, de Maret P, Schlebusch CM, Bostoen K (2021) Population Collapse in Congo Rainforest from AD 400 Urges Reassessment of the Bantu Expansion. *Science Advances* 7(7), DOI 10.1126/sciadv.abd8352
- Spriggs M (1989) The dating of the Island Southeast Asian Neolithic: An attempt at chronometric hygiene and linguistic correlation. *Antiquity* 63(240):587–613, DOI 10.1017/S0003598X00076560
- Spriggs M, Anderson A (1993) Late colonization of East Polynesia. *Antiquity* 67(255):200–217, DOI 10.1017/S0003598X00045324
- van Noten FL (1977) Une prospection au nord et nord-est du Zaïre. *Etudes d'Histoire africaine* 9–10:75–77
- van Noten FL (ed) (1982a) *The Archaeology of Central Africa*. Akademische Druck- u. Verlagsanstalt, Graz
- van Noten FL (1982b) The Iron Age in the North and East. In: van Noten FL (ed) *The Archaeology of Central Africa*, Akademische Druck- u. Verlagsanstalt, Graz, pp 69–76

- 1247 van Noten FL (1982c) The Stone Age in the North and East. In: van Noten FL (ed) *The Archaeology of
1248 Central Africa*, Akademische Druck- u. Verlagsanstalt, Graz, pp 27–40
- 1249 Vansina J (1979) Bantu in the Crystal Ball, I. *History in Africa* 6:287–333, DOI 10.2307/3171750
- 1250 Vansina J (1980) Bantu in the Crystal Ball, II. *History in Africa* 7:293–325, DOI 10.2307/3171667
- 1251 Vennetier P (1963) Les hommes et leurs activités dans le nord du Congo-Brazzaville. *Cahier O.R.S.T.O.M.*,
1252 Paris
- 1253 Vincens A, Buchet G, Elenga H, Fournier M, Martin L, de Namur C, Schwartz D, Servant M, Wirrmann
1254 D (1994) Changement majeur de la végétation du lac Sinnda (vallée du Niari, Sud Congo) consécutif
1255 à un l'assèchement climatique holocène supérieur: apport de la palynologie. *Comptes Rendus de
1256 l'Academie des Sciences, Series IIA, Earth and Planetary Science* 318:1521–1526
- 1257 Vincens A, Schwartz D, Bertaux J, Elenga H, de Namur C (1998) Late Holocene Climatic Changes
1258 in Western Equatorial Africa Inferred from Pollen from Lake Sinnda, Southern Congo. *Quaternary
1259 Research* 50(01):34–45, DOI 10.1006/qres.1998.1979
- 1260 Vogel JO (1978) The Gokomere Tradition. *The South African Archaeological Bulletin* 33:12–17
- 1261 White F (1983) *The Vegetation of Africa. A Descriptive Memoir to Accompany the Unesco / AETFAT/
1262 UNSO Vegetation Map of Africa*. Zenodo
- 1263 Whiteley PM, Xue M, Wheeler WC (2019) Revising the Bantu tree. *Cladistics* 35(3):329–348, DOI
1264 10.1111/cla.12353
- 1265 Willey GR (1945) Horizon Styles and Pottery Traditions in Peruvian Archaeology. *American Antiquity*
1266 11(1):49–56
- 1267 Wotzka HP (1993) Zur Tradition der Keramikdeponierungen im äquatorialen Regenwald Zaires: Ein Beken-
1268 ntnis zur allgemein-vergleichenden Analogie. *Ethnographisch Archäologische Zeitschrift* 34:251–283
- 1269 Wotzka HP (1995) Studien zur Archäologie des zentralafrikanischen Regenwaldes: Die Keramik des
1270 inneren Zaire-Beckens und ihre Stellung im Kontext der Bantu-Expansion, *Africa Praehistorica*, vol 6.
1271 Heinrich-Barth-Institut, Köln