Saving 1,000 years of African history : there is no evidence of a population collapse in Congo rainforest from 400 to 600 CE – 1. The radiocarbon dates.

Authors: Bernard Clist, James Denbow, Pierre Giresse, Maria Piedad de Jesus, Raymond Lanfranchi, Jean Maley and Christophe Mbida Minzie.

Pre Print for the *Science Advances* journal, response to the published paper "Seidensticker (D.), Hubau (W.), Verschuren (D.), Fortes-Lima (C.), de Maret (P.), Schlebusch (C.M.) & Bostoen (K.), 2021, Population collapse in Congo rainforest from 400 CE urges reassessment of the Bantu Expansion, *Science Advances*, Published online: 12 February 2021, Vol. 7, no. 7."

Seidensticker *et al.*'s interesting study uses "*an integrated multi-proxy approach*" that combines radiocarbon dates and pottery styles. The authors lump all pottery-using communities into an Iron Age, dismissing any idea of a "Stone to Metal Age" or "Neolithic". Iron, in fact, is widespread only from about 2,000 years ago (**1**). They also impose a sharp distinction between Early (EIA) and Late Iron Ages (LIA) not generally favoured by other researchers.

What is more, their 11 'regions' are determined by modern day international borders ('regions' A to D, Cameroon, Gabon & Equatorial Guinea, Congo, western Democratic Republic of Congo or DRC), or specific research programs ('regions' E to H, and J). The last 'region', I, is a catch-all that groups a few sites in Angola but omits 10 dates from Mbanza Kongo. The only 'region' making sense is K, Bioko Island, part of modern Equatorial Guinea. Each of the 'regions' is claimed to have been studied by archeologists who applied similar strategies and ceramic analyses: this is simply incorrect. We question, for instance, the association of dates hundreds of kilometers apart which lack cultural homogeneity, especially in 'regions' A (Cameroon) and C (Congo and western DRC).

An important study argues that a statistically significant survey needs at least 100 ^{14}C for a given geographical sub-set to adequately reflect major trends in settlement intensity (**2**). Since that study, other researchers have argued for a minimum of 200 ^{14}C dates: "*summed probability plots based on less than 200-500 radiocarbon dates should be treated as provisional and likely to change appreciably once larger datasets become available"* (**3**). Multiple publications worldwide have also discussed the problems in using dates to estimate populations (e.g. **3** & **4**).

Seidensticker *et al.*'s "*transparent classification system"* for ^{14}C dates leads to 1,149 dates "*considered to be reliable*" (Class I, subdivided into Ia to Id). We consider Class Id (n=90) identical to Class IIc: dates not associated with any archeological material. In the remaining 1,059 Class I dates (due to their context several should not be labeled Class I), we find 399 from zone A (Cameroon), 196 from zone B (Gabon and Equatorial Guinea), 205 from zone C (Congo and DRC), 88 from zone D (Congo, DRC, CAR), 28 from zone E (Congo), 32 from zone F (DRC), 28 from zone G (DRC), 9 from zone H (DRC), 8 from zone I (Angola), 53 from zone J (DRC) and 13 from zone K (Equatorial Guinea, Bioko Island). Statistically, most zones do not reach the minimum requirements, especially zones D to K, and illustrate rather a lack of research. Only zone A, with 399 dates (51% come from only 11 hilltops dotted over southern Cameroon) and zones B and C, with about 200 dates each, are relevant; but we find in A, 1 dated site per 2,876 km^2, in B, 1 dated site per 2,937 km^2, and in C, 1 dated site per 2,188 km^2.

Several large-scale studies exist of the growing corpus of ^{14}C dates from Central Africa (**5**). These studies, however, were not up to statistical standards, and their context was not systematically verified. In Seidensticker *et al.*'s Table S1, for instance, we find the same weaknesses. For example, 12 dates ranging over 1,000 years come from a single ancient pit at Oliga (Yaoundé, Cameroon), and 2 dates come from an old termite mound at Otoumbi 2

(Gabon) (**6**), while the authors ignore papers by L. Digombe and P. Schmidt that give the contexts of the EIA dates from Moanda, Gabon.

The best context is often ancient pits. Exceptional cases can yield up to 12, as at Oliga, but usually the numbers range from 1 to 3, leading to another discrepancy in the 'good' dates: they artificially boost the number of EIA dates from areas A and D-F. Eliminating multiple dates from a single feature, probably the result of a single historical event, reduces the Ia to Ic assays in specific 'regions', and in turn reduces the difference between the EIA and LIA. Multiple dates from one feature makes sense from an archaeological perspective, but not for past demography. What is the demographic significance of the 20 ^{14}C dates from as many features at the 16th – 18th centuries Ngongo Mbata town (DRC), the 27 ^{14}C assays from 17 features at the EIA Campo (Cameroon) site, and the Okala site (Gabon) with 9 dates from as many features and 3 separate and successive Neolithic villages (**7**) ? It is the range of dated features, not the number of dates, that is important. Consequently, the radiocarbon evidence does not support Seidensticker *et al.*'s conclusions.

We argue that the more complex or vast a site, the more excavated surface is needed along with more dates. The high numbers, however, will not necessarily be linked to past demography, but to excavation strategy and the research questions under investigation. The link to research design is well documented throughout sub-Saharan Africa (**8**).

We do find a deficit of ^{14}C dates from 1400 BP through the LIA, even though the number of recorded sites is much higher than for the EIA. This is supported by the genetics of Gabonese people mentioned by Seidensticker *et al.*, suggesting a population increase after the 11th century. Rather than a hiatus between the EIA and LIA, the lack of empirical data for the LIA is to be linked to academic disinterest, differing fieldwork practice, soil preservation conditions, and a low demography suggested by historical and ethnographical accounts from Central Africa all pointing to low populations densities (**9**).

Available data do therefore not support a '*population collapse in Congo rainforest from 400 CE*", especially when only western Central Africa ('regions' A to C) has barely sufficient evidence. We need more and better datasets to determine the best hypothesis: "*Only further archaeological research will make it possible to know if we are indeed confronted with a large-scale demographic phenomenon or if the current void is still the result of a lack of research.*'' (**10**: 457).

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