

Interactive comment on “Climate impact on the development of Pre-Classic Maya civilization” by Kees Nooren et al.

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Nooren et al. argue that development of ancient Maya Civilization, much as has been argued for its later disintegration, was highly dependent on climate conditions. Specifically, the authors attribute early agricultural expansion and urban development to drying in the Preclassic. The conclusions come from study of diatoms in a sediment core from Lake Tuspan, and changes in beach ridge elevation near the Usumacinta discharge on the Gulf of Mexico coast. The authors note that it has been difficult to tie all paleoclimate records from the Maya Lowlands together, and that there are apparent disagreements between climate “reconstructions.” This may reflect, in part, problems with dating such records. But the authors do an admirable job of pulling together numerous records (paleolimnological, paleoceanographic, and speleothem). The paper

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should be published and will be an important resource for archaeologists, ecologists and paleoclimatologists working in the region. I concur that late Holocene drying correlates temporally with the rise of Maya civilization, and have considered whether climate conditions finally became optimal for slash-and-burn (SAB) agriculture, i.e. just the right seasonality to fell the forest, dry it out, burn it and plant. I still have trouble sorting out how climate, in terms of total rainfall, might have prevented such activity earlier, give the dramatic gradient in annual rainfall across the Yucatan Peninsula today (especially north-south), which does not appear to prevent people from practicing SAB. Again, perhaps it had something to do with both how much rain fell and how it was distributed throughout the year. My comments are largely of an editorial nature and I will simply go through the manuscript and comment on a line-to-line basis.

Line

26 I'd change “while” to “whereas” as you are contrasting what the two records show
28 I believe it is more conventional to use a little pyramid symbol for the delta $14C$
47 I suggest something like “Evidence for such impacts is found in the fact that floods,
as well as droughts, are important themes... 49 change “Mayan” to “Maya” (the former refers to the language(s))
58 Tankersley et al. also made the pitch that the “Maya clay” had a volcanic origin. But it is important to be clear about how that is meant. It may well be true that much of the smectite clays come from weathering of ash, deposited over very long periods. But I think Tankersley et al. were referring to the massive deposits, e.g. in Peten lakes, having come from Holocene eruptions. There are many good arguments against that, like the fact that the clay is meters thick in some of the lakes, and the fact that even in lakes surrounded by active volcanoes, one sees ash layers, intercalated with organic lake sediment (Amatitlan). My guess is that land clearance on steep slopes in Peten, under relatively wet conditions (compared to the deglacial, e.g.), enabled rapid export of fine particles from local soils. That is a little off topic. 72 delete “likely” – it appears on line 71 85-86 It may be that many of the differences among paleo-precipitation records reflect constraints on dating. The

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only reliable lake-sediment dates come from terrestrial fossils, and we are still stuck with interpolating/extrapolating dates for depths where there are no datable materials. 97 change “70,700 km2 large catchment” to “70,700-km2 catchment” 108 change “has primarily been determined” to “was primarily determined” 136 Maybe it is worth noting that this is not the Rio Dulce that drains Lake Izabal (eastern Guatemala) 140 change to “exceeding a one-standard-deviation threshold” 164 change “by” to “of” 179 change “hematite stained” to “hematite-stained” 229 change “for” to “of” 233 change “last thousands of years” to “last few thousand years” 241 change “Centennial scale” to “Centennial-scale” 245 You use “The in-phase relationship between the two records is significant above a 5% confidence level at centennial timescales during the Pre-Classic Period.” As stated, I am not sure what that means. Do you really mean that you set the alpha value at 5%, and the probability of concluding the records are in-phase, when in fact they are not, is <5%. I think that should be re-worded for clarity. 248 change to “at a centennial time scale” 252 change to “gives us confidence” (refers back to “The coherence”) 254 I believe it is more conventional to use a little pyramid symbol for the delta 14C 257 I believe it is more conventional to use a little pyramid symbol for the delta 14C 258 change to “~500-year” 266 change to “At that time” 276 change to “centennial-scale” 279 change “due to” to “as a consequence of” and later in the line to “because of” 284 change to “During that period” 290 change to “Between 1000 and 850 BCE” 292 change “at” to “on” 295 change to “for further development” 301 change to “show strong and steady development” 304-305 Again, I wonder if it is drier conditions, or perhaps as important, how the rainfall was distributed through the year. Agriculture is practiced across a large gradient of annual rainfall today, using traditional methods. 623 change extend” to “extent” or “area” 630 I did not know what was meant by “the Cariaco record is conform updated age-depth model.” Why not just say “We used an updated age-depth model for the Cariaco record.” 632 I believe it is more conventional to use a little pyramid symbol for the delta 14C 637 I believe it is more conventional to use a little pyramid symbol for the delta 14C 639 change to “500-yr” 653 insert a period after “et al” 653 change to “Long-term” 668 Italicize “Aulacoseira” and “Pinus” (the latter

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in 3 places) 671 change “Ti -15 point running mean” to “Ti 15-point running mean” 675 change to “1-4-cm-thick” 676 change to “light-coloured” 685 change to “concentrations” 687 change to “4-12-cm” 690 change to “events” 692 change to “linear” 693 change to “radiocarbon-dated” 704 change “at al.” to “et al.” 711 change to “linear” 711 change to “4th-order”

Figure A1. How was it decided which archaeological sites to include? There are certainly many more, and this may mislead readers who are unfamiliar with the archaeology of the region. Also, might another colour be used for the Dulce River catchment. It appears that the area received >4000 mm/yr rainfall, being dark blue.

Figures 3, A2a, A2b. Is there any utility in indicating on those plots which way is drier and which is wetter? Also, for A2b, I suspect that the orange pollen percentages for Peten-Itza are “Montane” rather than “Montana” Figure A10 – change to “linear”

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