Interactive comment on “Turning sunlight into stone: the oxalate-carbonate pathway in a tropical tree ecosystem” by G. Cailleau et al.

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Received and published: 13 May 2011

Referee 1

Very little mention is made of the ‘normal’ model for soil carbonate precipitation, through equilibration of the 12C-rich high pCO2 soil atmosphere with the less 12C-rich lower pCO2 atmosphere (e.g. Cerling, 1984; Cerling and Quade, 1993). In this (physicochemical) scenario, one would expect carbonates in the soils around these C3 plants to have δ13C of around -9 to -12 per mil. This reï¬ects the soil zone and atmospheric CO2 contributions to the carbonate. Indeed, the soil carbonates around the plants do have such values. However in the upper 20 cm of the soil zone, one normally expects slightly more 13C rich compositions than lower down, due to a greater contribution to the soil carbonates from atmospheric CO2. Perhaps the authors could
comment on this in their paper, to strengthen their argument. Authors’ answer Yes, it is true. As we considered that the ‘normal’ model is well known, we decided not to refer to such a model and let the reader to form his own opinion regarding the iroko ecosystem. Nevertheless, things are a bit more complex as the atmospheric CO2 is only a partial contribution. Most commonly, the soil respiration is the major contributor in such systems. One weakness in the model (Fig 7) is the absence of data on soil zone DIC. Can the authors elaborate on the reason for this? No samples taken? Samples too small?

Authors’ answer: Field trips were performed during the dry season and no DIC sampling could have been performed at this time. In addition, no further sampling session has been possible due to the Ivorian civil war which started in September 2002.

Presumably the authors also have $\delta_{18}^{O}$ data for the carbonates? Does this $\delta_{18}^{O}$ reflect the composition of the meteoric water in the studied areas, or show any effects of evaporation which might have influenced carbonate precipitation? Does $\delta_{18}^{O}$ correlate with $\delta_{13}^{C}$? It would be interesting to know.

Authors’ answer: no rain sampling was made on sites (no precipitation) and as a consequence, no data could be obtained for rain $\delta_{18}^{O}$. We think that it is not possible to discuss such an issue as oxygen isotope data are not available.

The authors make much of the carbon-trapping potential of these ecosystems. What is the justification for 1) the assumption that the calcium comes from a silicate source, not a carbonate source (line 18), which (although depending on timescale) could be important for long-term CO2 sequestration,

Authors’ answer: See Cailleau et al 2004 (no carbonate in the basement, no carbonate input for atmospheric sources). The conventional soil pH (away from an oxalotrophic
system) is too acidic to store airborne calcium carbonate. In addition, on a larger timescale (with a hypothetically different dust deposition regime), it seems unlikely that a Ca uptake could take place from an inherited airborne calcium carbonate.

and 2) can the authors estimate how much CO2 these ecosystems might remove from the atmosphere over a given period of time?

Authors’ answer: It has been estimated that approximately 980kg of carbon (as carbonate) are accumulated in the soil surrounding a studied iroko (Cailleau et al 2004). A recent 14C date, revising the tree’s estimated age given in Cailleau et al 2004, gives an age of 170+/-30 yr. Consequently, 980kg of carbon represent 82000 moles of C and are equivalent to 3.5 tons of CO2 withdrawn from the atmosphere during the tree lifetime (without counting the biomass).

How important are they to the modern and ancient global carbon cycles? The conclusions could also be made much stronger.

Authors’ answer: The importance of these carbonate accumulations are discussed by Cailleau et al 2004. Nevertheless, refinement of the calculations, given in this paper supported by 14C, are presented in Cailleau’s PhD thesis manuscript available at http://doc.rero.ch/record/5512?ln=en. Comparison to marine environments (Milliman 1993’s data) is available on Page 74, figure 5.7. As an example, C sequestration deficit due to deforestation and logging of iroko in all Africa is evaluated as 1 to 2 orders of magnitude less than several types of marine environments such as coral reef complexes, banks/bays, and non-carbonate shelves.
L2: Milicia excelsa replaces Milicia excelsa

L19: agents replaces gents; saprophytic is added before fungi

L21: agents replaces gents

L23: then is added before start

P.1079

L4: defined by ecological replaces defined by the ecological

L15: comma deleted after process

L20: Authors’ answer concerning a reference to Berner’s papers: as we are specifically speaking of the oxalate carbonate pathway related to the iroko tree, a reference to one of Berner’s papers appears irrelevant in this case.

L23: this system works only in the presence replaces this system works with only the presence

P.1080

L1: we used microscopic replaces we propose to use microscopic

L14: involving replaces through the; saprophytic is added before fungi

L17: powdery replaces pulverulent

P.1081

L9: large replaces important

L18: were replaces have been
L19: binocular microscope replaces binoculars
L6: binocular microscope replaces binoculars
L8: any possible replaces possibly
L13: centrifuged replaces centrifugated
L20: were replaces have been
L22: were replaces have been
L24: were replaces have been
L26: were replaces have been
P1083
L1: were replaces have been
L2: After replaces Next to
L6: was replaces has been
L11: does not replaces is not supposed to
L13: a good way to obtain replaces the only way to get
L14: were replaces have been
L16: were measured replaces have been performed
L18: V-PDB replaces PDB
P1084
L2: Authors’ answer concerning “by important do you mean large?”. Yes, large replaces important; Many replaces A lot
L6: reflecting the replaces meaning
L8: feeders/borers replaces feeder/borer
L19: binocular microscope replaces binocular
L21: were replaces have been

P1086
L15: rhombohedron replaces rombohedron
L21: were replaces have been
P1087
L1: were replaces have been
L7: with the data replaces to the data
L10: was replaces has been
L11: were replaces have been
L12: were replaces have been
L24: only the top twenty replaces only the twenty first
P1088
L7: Experiments replaces Experimentations
L8: up to 600 replaces until 600
L16: incineration at over 500 replaces incineration over 500
P1089
L21: this flux (not measured in this study) should lead replaces this flux not measured in this study should lead
P1092
L13: at the Biga site replaces at Biga site
L14: Authors’ answer concerning could happen, instead of should happen? No, be-
cause as we are considering a system leading to carbonate accumulations, the steps
mentioned in this section should happen (except for silicification)
L18: wounding replaces wounds
L22: starts building replaces constituting
L25: evidence replaces clue
L26: these two mineralizing phases replaces these two phases
L28: delete implication of the

P1093
L4: pseudomorphoses replaces pseudomorphosis
L6: based on field and petrographic observations replaces based on field observation
as well as petrographic and diagenetic observations
L13: delete the before Fig. 5
L18: binocular microscope replaces binocular; top twenty replaces twenty-first

P1094 L2: I think you should add a comment here about the ‘normal’ situation for soil
carbonates formed in the top 20 cm of the soil (relatively 13C rich).
Authors’ answer : We do think that this is going to lengthen the text, which already fairly
long, without bringing any real input. Nevertheless, the remark regarding the C isotope
distribution is pertinent.
P1095
L2: delete important
L3: can replaces has to
L17: delete the

P1096 The conclusions can be strengthened to reflect the rest of the manuscript.
Authors’ answer: The conclusions have been edited.

L.15: not otherwise expected replaces not expected

Figures: increase the font size in Fig. 7.
Authors’ answer: The current format of the discussion paper will be increased and the authors think the size will be fine. In case the font will not be readable in the final proof version, a size increase will be applied.

Interactive comment on Biogeosciences Discuss., 8, 1077, 2011.