

Interactive comment on “Evidence of old soil carbon in grass biosilica particles” by P. E. Reyerson et al.

P. E. Reyerson et al.

gdossant@uci.edu

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We agree with referee #2 that we have a rather large and complex dataset produced from different laboratories and a variety of experimental approaches to address a somewhat simpler issue, the non-photosynthetic origin of phytC. This issue has direct implications to the utilization of phytC as an atmospheric CO₂ sink and as a dating material in archaeology.

In retrospect, the non-photosynthetic origin of phytC has been already addressed, but is still questioned in the literature. Radiocarbon offsets as large as ~8ka yrs BP between phytC extracts and plant tissue have been reported elsewhere, followed by discussions on the possible mechanisms involving soil-C adsorption by roots through

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amino-acids (see Santos et al. 2012). Although the previous evidence was solid, conceptual inconsistencies in this field continue, even when similar or higher phytC 14C discrepancies than those reported here were shown (e.g. Sullivan and Parr 2012, Yin et al. 2014, and most recently Piperno 2015). Those inconsistencies are mostly attributed to the difficulties encountered by those scholars in interpreting 14C bomb pulse methodology data, and poor laboratory practices (Santos et al. 2012b, Santos et al., manuscript submitted to JAS), or by refusing to accept the soil-C to phytC hypothesis (if the presence of older C in phytC is not due to a technical artifact, another source of C must be present).

The present experiments and multiple analyses were designed to definitively settle the questions posed by Santos et al. (2010), regarding the anomalously low 14C values of phytC extracts. Our present findings provided suitable evidence that 14C phytC offsets actually occurred in association with a soil-C contribution to phytC, regardless of the protocol adopted. We show that phytC from harvested plants from known ages contains a non-photosynthetic fraction adsorbed from the soil-C pool that will always bias 14C signatures, and that by inference: a) dating of pre-bomb period phytC concentrates extracted from soil pools will always yielded depleted (older) 14C values, than the expected age of plant of origin; b) when older fractions of soil-C within plant tissue are not completely oxidized the 14C phytC age offset will tend to increase; c) the accepted %C in phytC is largely overestimated, and combined to the fact that portions of it are from a non-photosynthetic source, the hypothesis of phytC as an atmospheric CO₂ sink is automatically invalidated. Furthermore, since soil-C compounds and ages are highly variable in soils and phytolith extraction protocols can isolate the heterogeneous pool of C in phytoliths differently, there is no way to correct for the soil-C fraction within phytC, so that phytC can be used as a reliable dating material.

In agreement with referee #2, we will try to make those messages more clearly in our revised version. We will also better explain the number of samples measured in the text, so that those will better match with the number of duplicates reported in the

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supplemental material tables. Although the protocols we used have been reported elsewhere (Corbineau et al. 2013), we will add a detailed explanation in the text, and reformat some sections of our manuscript for a better flow.

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