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Forum Comment

Comment on the paper in Quaternary International: “Methodological concerns for analysis of phytolith assemblages: Does count size matter?” (C.A.E. Strömberg)

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For the last three decades, fossil phytolith assemblages from soils, buried soils and lake sediments have been used, in addition to other vegetation indicators, to reconstruct paleovegetation changes. However, in the objective of strengthening further accuracy for these reconstructions, and in addition to comparison with reference plant collections, recent effort has been made to provide quantitative relationships between modern phytolith assemblages from soils, vegetation and bio-climatic parameters (e.g., Alexandre et al., 1997; Fredlund and Tieszen, 1997; Brémont et al., 2004, 2005a, b, 2008; Blinnikov, 2005; Albert et al., 2006; Lu et al., 2006; Barboni et al., 2007). Along this line, Stromberg (*Quaternary International*, this volume) presented a paper entitled “Methodological concerns for analysis of phytolith assemblages: Does count size matter?”, articulated on (1) calculation of confidence intervals related to count size and (2) investigation on how addition of these confidence intervals may affect vegetation interpretations. The first point is a relevant contribution for increasing accuracy of phytolith data. We comment here on the second point.

For the purpose of her demonstration, the author used published modern phytolith data from West Africa (Brémont et al., 2005a, b) for which she misinterpreted the vegetation significance. The phytolith index D/P was first presented by Alexandre et al. (1997) and later further defined by Brémont et al. (2005a) as the ratio of ligneous dicotyledon phytolith type (globular granulate) characteristic of trees in tropical areas of low elevation, over the sum

of Poaceae phytolith types (elongate types excepted). This phytolith index was calibrated, using phytolith assemblages from a forest-savanna transect in Cameroon (Africa), as a proxy of tree cover density or LAI (Leaf Area Index), through a statistical function: $LAI = (6.97 \pm 2.12 \times D/P) / (D/P + 3.82 \pm 1.96)$ (Brémont et al., 2005a). The explained variance (r^2) was 0.76 and the reproducibility on the measurement of D/P was $\pm 6\%$ (1σ) (calculated from double counting of a same slide ($\sigma_{(D \text{ and } P)} = \pm 3\%$; $\sigma_{(D/P)} = \pm 6\%$)).

The authors cautiously did not fix any threshold values of D/P that could be used elsewhere for discriminating vegetation formation such as moist forest, dry deciduous forest, tree savanna or grass savanna (physiognomic delimitation defined by the Yangambi scheme for the classification of African vegetation, CSA (1956) or Boughey (1957)). On the contrary, the authors drew particular attention to geographical and methodological limits of the application of the transfer function. They cautiously note that this transfer function could underestimate the LAI when Palmae phytoliths (globular echinate) are locally present in significant amount and when the proportion of Poaceae parallelipipedal bulliform cell phytoliths does not increase proportionally with Poaceae short cell phytoliths.

The reinterpretation of Brémont et al. (2005a, b) by Stromberg contains the following approaches:

- (1) Without taking into account the geographical and methodological application limits defined in Brémont et al. (2005a), the author took two D/P values locally measured by Brémont et al. (2005b) and used them as threshold values for interpreting a different modern

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data set (Bremond et al., 2005b) that does not fit the application domain requested for applying the LAI proxy. The second data set from Bremond et al. (2005b) is characterized by abundant parallelipedal bulliform cell phytoliths from Poaceae that do not increase proportionally with Poaceae short cell phytoliths.

- (2) Moreover, the 1.82 D/P value presented by the author as a general forest/tree-savanna threshold is actually the lowest D/P value locally measured for the *Rinorea* and *Albizia* forests by Bremond et al. (2005a). Instead, when using the transfer function (Bremond et al., 2005a), D/P values that make the local boundary between the shrub and tall grass savanna ($LAI < 1.2$) and the *Rinorea* and *Albizia* forests ($LAI > 2.68$) range from 0.8 to 2.4. Again without using the calibrated transfer function, the author arbitrarily chose a D/P value of 0.6, locally measured for the shrub and tall-grass savanna, as a general threshold value between shrub or tree savanna and savanna.

The use of these approaches makes the re-interpretation of the original phytolith data from Bremond et al. (2005a, b) erroneous and misleading.

Any overview of the studies calibrating the relationships between phytolith, vegetation and climate data indicates a basic limit, inherent to the phytolith tool: because of (1) multiplicity and redundancy in phytolith production, (2) different phytolith productivity from one taxon to another, (3) different phytolith productivity inside a given taxon, whatever its assigned rank is, and (4) selective dissolution or fragmentation of phytoliths in litters and soils, in relation to different environmental conditions, each calibration, and each relationship must be used with caution when applied to other application domains and to discontinuous records. Increasing development of quantitative calibrations for different vegetation types from different regions and different continents are needed for further constraining the use of phytolith assemblages to reconstruct past vegetation changes.

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