

Letters

Phytolith Analysis

Heather Pringle (Special Section, Archaeology, 20 Nov., p. [1446](#)) cites recent plant opal phytolith research by Dolores Piperno and Deborah Pearsall bearing on the question of agricultural origins in South America. Those of us with long experience in the development of phytolith analysis are convinced it has enormous potential, especially in such areas as archaeobotanical research. However, identification using phytoliths is complex and difficult to apply at refined levels of taxonomy. The evidence cited as the basis for major revisions of the time and place of agricultural origins in South America is grounded in taxonomic protocols that are questionable, and conclusions derived from them are premature at best.



What is the quality of the evidence given by phytoliths (right, 100 micrometers in diameter) about the origins of agriculture in South America? CREDITS: (LEFT) M. GUERRA/SMITHSONIAN TROPICAL RESEARCH INSTITUTE:(RIGHT) D. PIPERNO/SMITHSONIAN TROPICAL RESEARCH INSTITUTE

Problems of phytolith systematics remain daunting in spite of considerable progress. Phytoliths are structural elements, so homologous structures in unrelated plants often produce the same silicified morphological form. For example, the spherical phytolith illustrated prominently in the article is a form that can be produced in squash (*Cucurbita* sp.), but not exclusively. This same allegedly squash-derived form is produced in unrelated flora of the Ecuadorian region, such as *Bursuraceae*, as Piperno illustrates (1) and in *Annonaceae* (2). In addition, we know from control studies that soil conditions, especially available moisture, can cause substantial variation in the mean and range of size values in phytolith populations derived from members of the same species from one year or one place to the next. On the other hand, shape remains stable even in the presence of significant size modulation. The evidence of size change in spherical phytolith populations is presented in the context of a period of climatic change. Thus the evidence for domesticated squash is ambiguous. Phytolith size difference is not by itself proof of domestic versus wild taxa. It is not even certain that either or both populations purported to show a transformation from wild to domestic squash are, in fact, derived from squash.

Likewise, the classification methods developed by Pearsall and Piperno to identify domestic maize in remarkably early South and Middle American contexts emphasize the use of size parameters in highly questionable ways. Here again, increased size values of phytoliths in domestic maize are supposed to distinguish it from wild grasses (1, 3). However, size values of archaeological phytolith assemblages offered as evidence of domestic maize in earliest Valdivia I and II (Ecuador) contexts are *larger* than the size values presented for any and every modern reference maize tested (4). The conclusion is inescapable. Either there is systematic error operating in the analysis or we must accept the bizarre explanation that the earliest primitive maize to appear in South America is more modern in its phytolith content than is modern maize currently grown in the region.

As Gail Fritz is quoted in the article as saying, the phytolith evidence as presented to support a major revision backward in time for the origin of agriculture in South America is simply not to be believed.

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References

1. D. Piperno, *Phytolith Analysis: An Archaeological and Geological Perspective* (Academic Press, San Diego, CA, 1988), p. 241, plate 76.
2. F. Runge and J. Runge, in *The State of the Art of Phytoliths in Soils and Plants*, A. Pinilla, J. Juan-Tresserras, M. Machado, Eds. (Monografias 4, Centro de Ciencias Medioambientales, Madrid, 1997), p. 79, figures 1 and 11.
3. D. Pearsall, *Paleoethnobotany: A Handbook of Procedures* (Academic Press, San Diego, CA, 1989).
4. -----, *ibid.*, p. 332, table 5.2.