nal statement that the improved efficiency of making transgenic livestock by injecting oocytes "might even make livestock cloning obsolete." It is true that a particular gene incorporated into the germ line of a bull might be widely disseminated through the use of the bull's sperm for artificial insemination. But one must recognize that the technique of inserting a gene into a cow's oocyte, followed by fertilization, culture, and transfer produces an embryo of unknown genotype. Every oocyte used will be genetically different and progeny produced will be different. Many will not be superior for use in commercial agriculture. Cloning of cell lines derived from selected superior genetically engineered livestock, for example, likely will not be obsolete.

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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?

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 domes-

CREDITS: (LEFT) M. GUERRA/SMITHSONIAN TROPICAL RESEARCH INSTITUTE; (RIGHT) D. PIPERNO/SMITHSONIAN TROPICAL RESEARCH INSTITUTE

tic 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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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 Medioanbientales, 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.

Science and Technology at the State Department

I agree wholeheartedly with the sentiment expressed by Anne Keatley Solomon (Policy Forum, *Science*'s Compass, 27 Nov., p. 1649) and J. Thomas Ratchford (Policy Forum, *Science*'s Compass, 27 Nov., p. 1650) that the U.S. State Department must upgrade and support its science and technology capabilities. There is no doubt that science and technology are increasingly important in the definition and execution of U.S. foreign policy. I take issue, however, with the suggestion that the technical agencies should provide the human and financial resources to achieve this goal. Solomon proposes that "The new bureau's core staffing could be enhanced by temporary personnel transfers from the mission agencies...," while Ratchford says the "federal R&D [research and development] agencies should...provide personnel to State for overseas posts...."

I served in the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) with responsibility for international relations and worked closely with the State Department in a variety of activities. There was never enough staff in the State Department's Bureau of Oceans and International Environmental and Scientific Affairs to expeditiously handle the interagency clearance of international agreements, nor was there enough to support other activities where a foreign policy voice was needed. NASA and NOAA regularly contributed personnel and took on administrative support tasks that more properly should have been handled by the State Department. The technical agency staffs were also strained by their workloads, and the added burden of filling in for the State Department took away from the performance of our core duties; but it was essential, and so we did whatever we could. It is not, however, an arrangement that should be advocated as a permanent solution.

There should be close cooperation between the State Department and the technical agencies. Both would benefit greatly from regular exchanges of personnel. But it is unfair and detrimental to put the burden on the program agencies to fill a legitimate and important void in the State Department. Congress should ensure that adequate funding and appropriate authorization are provided to the State Department to carry out its mission. Otherwise we are reinforcing the idea that science and technology are really someone else's job and not an integral part of the foreign policy agenda. Let the State Department hire the best people it can, and encourage the R&D agencies to provide guidance and advice along the way. Create opportunities for the best and the brightest in any agency to contribute through diplomatic service, as well as through service in scientific and technical programs. But let the State Department step up to its rightful responsibilities and work as a strong, competent partner with the other agencies.

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CORRECTIONS AND CLARIFICATIONS

The 4 December NetWatch item "The buzz on bugs" (p. 1779) incorrectly described 13-year and 17-year cicadas (genus *Magicicada*) as "show[ing] up in late summer." Those cicadas emerge in late spring (May–June) and are gone by July. It is the dog day cicadas (genus *Tibicen*) that emerge in mid- to late summer and make up the "raucous bands" described in the article.