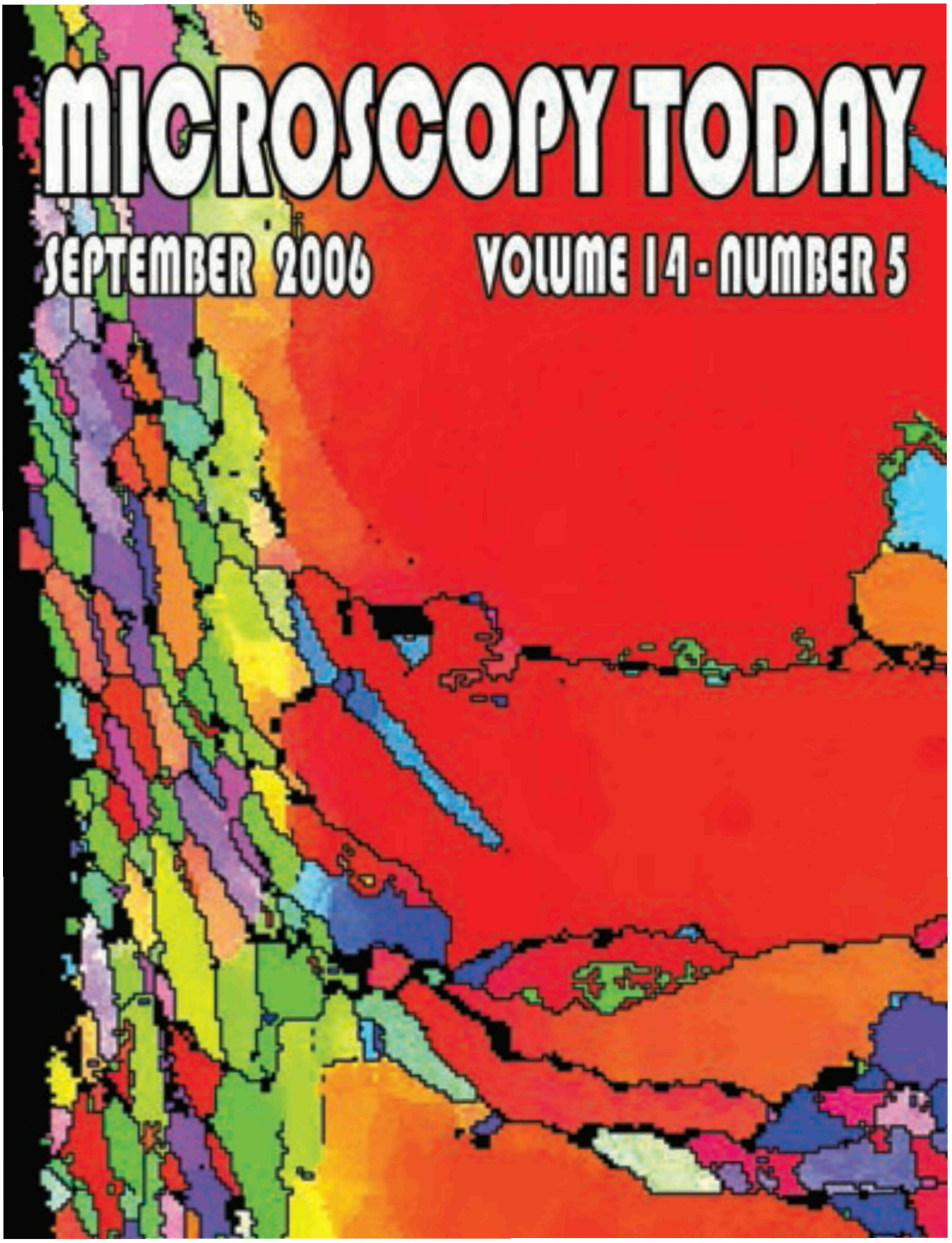

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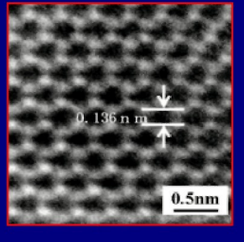

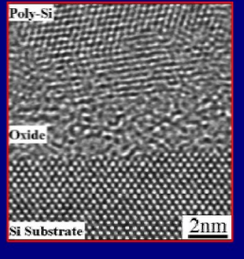

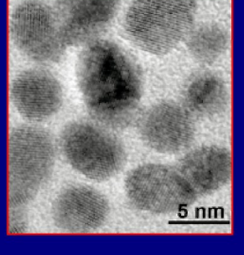

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When Did Agriculture Begin?

Stephen W. Carmichael[1]
Mayo Clinic
carmichael.stephen@mayo.edu

It has generally been considered that cereals (such as wheat, rice, and maize) were the first crops to be cultivated by human beings. But a new study that included scanning electron microscopy, by Mordechai Kislev, Anat Hartmann, and Ofer Bar-Yosef (micrographs by Yakov Langsam) provides strong evidence that figs were the first agricultural crop in human history.[2]

Kislev *et al*. recovered nine fig fruits (plus many nutlets called drupelets) from the ruins of a burned building near Jericho. The fire had carbonized the fruit which helped preserve the morphology of the specimens. The site was radiocarbon dated to 11,400 to 11,200 years ago. Microscopic analysis demonstrated that these specimens were of an edible fig that produces drupelets without embryos; that is, these fruits are sterile. Wild fertile figs have a symbiotic relationship with a wasp that plays an essential role in pollinating the fruit, but this fruit is inedible. In this study, no evidence of wasps or where a wasp could exit the fruit were found and these are features found in wild fruit. In other words, wild figs that can be pollinated and reproduce without human intervention are inedible, but edible figs require human intervention. The specimens examined in this study were of the latter variety.

The human intervention that apparently was required was to be purposefully propagated by people planting and tending shoots for generations and generations of fig trees. It is now known that the edible fig is a genetic mutant of the inedible wild fig. What appeared to have happened as long as 11,400 years ago is that "farmers" discovered this edible fruit would not propagate on its own and learned that it could only be raised if they took an active role. Other fruit trees, such as the grape, olive, and date, can be similarly propagated, but other studies have suggested that this occurred about 5 millennia after these fig specimens.

Co-incidentally, a "Perspectives" article in the same issue of *Science* described how ancient farmers turned weeds into cereal crops.[3] John Doebley pointed out that a central feature for domestication of cereals is that the grains must remain on the plant for harvesting by humans, rather than falling (in this context, referred to as "shattering") from the plant, as required for a wild species to propagate. Quantitative locus mapping has convincingly shown that the loss of shattering arose through a relatively small number of genetic changes, allowing weeds to change to domesticated cereals. Careful selection of these harvestable mutants was probably the earliest stage of farming cereals. Although the studies supporting this did not use microscopy, Doebley pointed out that these genetic changes occurred about 10,000 years ago. If this is true, then agriculture probably began when humans first stuck fig branches in the ground about 11,400 years ago! ■

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1 The author gratefully acknowledges Drs. Mordechai Kislev and John Doebley for reviewing this article.

2 Kislev, M.E., A. Hartmann, and O. Bar-Yosef, Early domesticated fig in the Jordan Valley, *Science* **312**:1372-1374, 2006.

3 Doebley, J., Unfallen grains: How ancient farmers turned weeds into crops, *Science* **312**:1318-1319, 2006.

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ABOUT THE COVER

Electron backscatter diffraction map of a micro-wear scar in an electrodeposited Ni micro-electro-mechanical system (MEMS) device. The wear scar was produced by moving a Si_3N_4 ball, loaded with 100g, across the surface of the device 1000 times. The extent of the wear-induced sub-surface deformation and damage is easily visualized from this map. The image size is 8 µm x 10 µm. See the article by Michael, *et al.*, page 6.