

edited by Gilbert Chin

### PALEONTOLOGY

#### Early Toolmakers

The Hadar Formation, exposed by the Awash River in Ethiopia, has yielded hominid fossils spanning several million years, including Lucy (*Australopithecus afarensis*), dated to more than 3 million years ago (Ma). The uppermost part of the Hadar (now designated as the Busidima Formation) also hosts what seem to be the oldest known tools, chiseled river cobbles, and associated debris flakes, dated to about 2.6 Ma. Quade *et al.*

document how the environment of the Hadar Formation evolved along with these early hominids. Their analysis shows that the river flowed through forest, mixed with some grassland, which expanded as the climate dried. Early stone tools were collected from cobble bars in the main river and processed nearby, but up on the banks. Later, cobbles were transported farther away. Interestingly, the first occurrence of tools is found above the abrupt appearance of cobbles younger than 3 Ma in the section. These tools may thus represent the appearance of a local resource rather than marking the true technological innovation, which would have happened earlier. — BH



A view of the east bank of the Kada Gona River.

*Geol. Soc. Am. Bull.* 116, 1529 (2004).

### CHEMISTRY

#### Almost as Bright

Tracking particles and cells in the fluorescence microscope is a key analytical technique in cell biology and materials science. Increasing demand has led to the synthesis and functionalization of new fluorophores and semiconductor nanoparticles (quantum dots). However, many fluorophores are readily photobleached and not very bright, whereas quantum dots require capping layers to prevent aggregation, and their synthesis requires harsh solvents and precursors.

Ow *et al.* have created a hybrid structure with an organic fluorophore covalently attached to a silica precursor, forming an organic core surrounded by a thin silica shell, which is then encapsulated using sol-gel chemistry to make particles 20 to 30 nm in diameter. Adding the outer shell of silica increased the brightness by a factor of 30. One reason is that the shell protects the fluorophore from solvent, which also increases its photostability. The silica nanoparticles are not quite as bright as similarly sized quantum dots, but they can be easily functionalized using the well-established and broad library of silane coupling methods. — MSL

*Nano Lett.* 10.1021/nl0482478 (2004).

### SEISMOLOGY

#### Urban Hazards

In comparison to the four-fold increase in the world's population to about 6 billion, the percentage of people killed in earthquakes declined only slightly from 1900 to 2000. Although this trend has been assumed to reflect better building codes, Bilham's analysis suggests

### IMMUNOLOGY

#### Treating Disease with Worms

Crohn's disease is a debilitating inflammatory condition of the intestine. Although the etiology is unclear, the disease is thought to result from inappropriate activation of the immune system against the bacterial flora of the gut. In developing countries, where infection with parasitic intestinal helminths is widespread, Crohn's disease is rare, leading to the notion that the allergic-like state generated by parasitic worms counteracts proinflammatory influences.

To test this, Summers *et al.* fed Crohn's patients eggs of the common pig helminth *Trichuris suis*, which can colonize the human intestine for short periods without pathology. A marked improvement was seen in most of the patients, and these clinical results are paralleled by the observations of Elliott *et al.*,

who found that giving the helminth *Heligmosomoides polygyrus* to mice that were afflicted with a Crohn's-like condition reversed inflammation. In protected animals, there was a redress of the imbalance toward proinflammatory cytokines, and these early results suggest that unconventional therapy of this type might be effective in treating a range of chronic inflammatory diseases that extend beyond the gut. — SJS

*Gut* 54, 87 (2005); *Eur. J. Immunol.* 34, 2690 (2004).

### EVOLUTION

#### Nothing in Common

Analyses of the diversity of marine genera through the Phanerozoic have identified five great global mass extinctions. Bambach *et al.* use Sepkoski's compilation of the stratigraphic ranges of genera at the stage and substage levels to evaluate the continuity of these five big events with background extinction.

They see six major temporal intervals of alternating high and low extinction intensity. The Late Devonian and end-Triassic diversity crashes occurred during intervals of generally high extinction and low origination. For these events, extinction intensities—although higher than the average for the inclusive interval—are not distinct outliers, and almost two-thirds of the diversity loss is explained by reduced origination. For the end-Ordovician, end-Permian, and end-Cretaceous events, origination rates exceed those in their temporal neighborhoods, and extinction rates are exceptionally high. These three events appear to differ from each other and from the other two in their physiological selectivity, their ecological impact, and the nature of their effects on particular taxa, and hence are unlikely to be due to a common cause. — SJS

*Paleobiology* 30, 522 (2004).

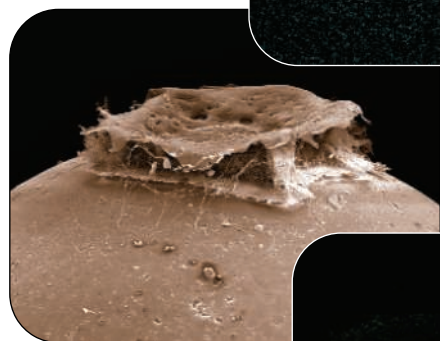
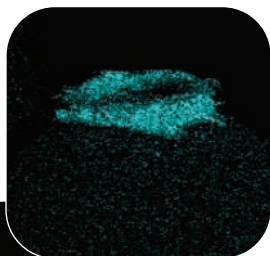
that this is not quite so, because (i) the number of fatalities per year is increasing; (ii) extreme events are not considered in the analyses; and (iii) the greatest seismic hazards and largest number of historic fatalities are concentrated in five countries: China, Iran, Italy, Japan, and Turkey, such that averaging over the global population tends to minimize the real problems. Today, there are about 100 cities of more than 3 million people, and half of these lie in earthquake zones. Soon, more people will live in cities than in rural areas, and by 2030 the population of Tokyo is predicted to reach 70 million. Combining the concentration of people in larger cities with the faster pace of construction caused by rapid growth means that it will be imperative to improve building codes and to monitor compliance more stringently in order to reduce earthquake fatalities. — LR

*Seismol. Res. Lett.* 75, 706 (2004).

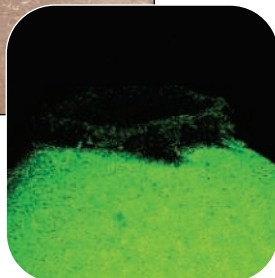
## BIOCHEMISTRY

### Quick-Drying Foam

Sandcastle worms build shelters for themselves by gathering sand grains and gluing them together into a sturdy tube, using a rather sophisticated construction material. Stewart *et al.* have analyzed the structure and composition of this glue,



The phosphorous-rich cement disk on top of a glass bead.



which contains three highly charged proteins: two are basic, whereas the third, acidic component accounts for the 30 mol % of phosphoserine in the cement. Concentrating these proteins (along with  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  to neutralize

charge) within low-pH secretory granules in the cement gland initiates a process of complex coacervation. Phase separation occurs, yielding an emulsion-like blend of dehydrated proteins and cations along with water-rich droplets. When this mixture is daubed onto a sand grain, several changes occur, due in part to the higher pH and different ionic composition of seawater. The cation-phosphate interactions become ionic or salt-like in character, and the solvation of charges acts to soak up water from the cement/sand interface, improving contact as the cement sets. The hardened cement displays a cellular foam morphology, reflecting the separated phases, which also confers benefits in terms of an economy of material and a gradient of elasticity ideally suited to life in the intertidal zone. — GJC

*J. Exp. Biol.* 207, 4727 (2004).

## MEDICINE

### Fighting Arrhythmias

People who have suffered a heart attack have a high risk of developing life-threatening arrhythmias. Because drugs do not effectively reduce this risk, there has been increasing interest in the prophylactic use of implantable cardioverter defibrillators (ICDs): electronic devices that detect arrhythmias and shock the heart back to its normal rhythm. The success of ICDs in early clinical trials has been a cause for optimism but has also prompted debate about how widely these devices should be used, given their cost (\$20,000 each).

The results of a clinical trial by Hohnloser *et al.* suggest that ICDs provide much less benefit to patients when they are implanted within 6 weeks of a heart attack, as opposed to months or years later. Based on the results of a meta-analysis, Desai *et al.* conclude that ICDs can significantly increase the survival of a different group of patients—those who have a high risk of cardiac arrhythmias because of a heart condition called nonischemic cardiomyopathy. Together, these results emphasize the need for more extensive studies to define the patient populations most likely to benefit from these devices. — PAK

*N. Engl. J. Med.* 351, 2481 (2004); *JAMA* 292, 2874 (2004).