EDITORS' CHOICE

edited by Gilbert Chin

PALEOCEANOGRAPHY

A Proxy for Water

The geographic distributions of the size and morphology of modern foram assemblages show that these traits depend on environmental conditions, such as temperature, nutrient availability, and community structure. Because these conditions vary as climate fluctuates, it has been assumed that they would influence forams in a temporal sense as well as a geographic one.

Schmidt *et al.* report that the sizes of planktonic foraminifers change in response to environmental conditions during glacial-interglacial cycles, and that these changes mimic the geographic size variability seen for the Holocene. The amplitude of the changes is directly related to the amplitude of water temperature variations over these periods, and change in assemblage size is linked to species replacement or intraspecific variability, depending on the environmental setting. These results support the idea that the ecological preferences of individual species have not changed much during the past 300,000 years, and suggest that the similar size distributions seen in the last three interglacials imply that the environmental conditions experienced by the planktonic foraminifers were similar as well. On the downside, these findings may complicate the interpretation of studies that use variations in the foraminifera weight as a proxy for the carbonate ion concentration of the ocean across glacial-interglacial intervals. — HJS

Paleoceanography **18**, 1039 (2003).

ECOLOGY/PALEOCLIMATE

A Proxy for Air

The frequency and density of stomata (the pores in the surfaces of leaves, through which gases and water vapor transit) are known to vary with the atmospheric CO_2 concentration present when the leaves developed. Also, the carbon isotope ratios in leaf cuticles vary according to the microclimatic conditions (sun, shade, and precipitation) experienced by leaves. On the basis of these relationships, stomata have been used as proxies to quantitate past CO_2 concentrations by measuring their variation in museum specimens and fossils and comparing these values with those of extant plants of the same species.

***Ginkgo biloba* leaf.**

"Living fossils" such as *Ginkgo* (and *Metasequoia*, see Editors' Choice, 30 May, p. 1343) are especially prized for such studies because their fossil record extends back through the Mesozoic and therefore provides a good record of atmospheric conditions over the past 200 million years. However, it is important to establish that the variation observed in fossils can be interpreted in the same way as that observed in present-day plants. In a study of *Ginkgo* leaves from a variety of positions (sun and shade) and climates in China and the United Kingdom, Sun *et al.* show that stomatal index (the percentage of leaf epidermal cells that are stomata) is almost constant under different climates and that the variation in carbon isotopes matches that of fossil *Ginkgo* cuticles. These results suggest that photosynthetic physiology and leaf morphology have been conserved over the evolutionary history of these trees, strengthening their reliability as proxies for atmospheric change. — AMS

Proc. Natl. Acad. Sci. U.S.A. **100**, 7141 (2003).

IMMUNOLOGY

Slowing Things Down

In the course of an inflammatory response, lymphocytes enter the tissue bed from the microcirculation by squeezing through the blood vessel wall in a process known as extravasation. Yet normal blood flow within microvessels generates shear stress that would detach and sweep away any lymphocytes that had adhered to the vessel endothelium in the first place. So how do lymphocytes hang on?

Secomb *et al.* observe that microvessels can alter their local architecture to reduce shear stress substantially. Imaging of vessels in sheep skin was used to measure lymphocyte velocities after topical application of oxazolone—a hapten known to recruit lymphocytes; flow rates decreased in regions corresponding to apparent focal enlargements in the vessel walls. Scanning electron microscopy showed these to be balloonlike dilations between the capillary and postcapillary venules, and they were designated as microangiectasias. Estimates of shear wall stress within these regions yielded forces comparable to those mediating lymphocyte adhesion in vitro. — SJS

Proc. Natl. Acad. Sci. U.S.A. **100**, 7231 (2003).

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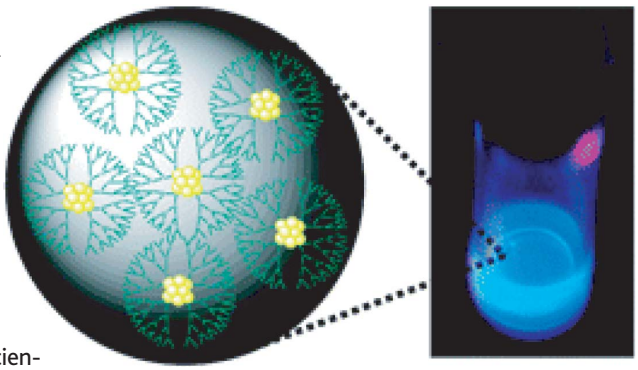
CHEMISTRY

Fluorescent Gold

Dendrimer-coated gold clusters.



The optical properties of small metal clusters consisting of tens of atoms often differ from those of the same materials in bulk form. The clusters behave more like molecules than metals, with discrete transitions between electronic states that are associated with characteristic emissions. Gold nanoclusters that are fluorescent have been prepared, but the distribution of particle sizes was too broad and the emission efficiency too low for practical application.

Zheng *et al.* describe the synthesis of monodisperse eight-atom gold clusters that emit blue light with 100 times higher efficiency and that may be usable as fluorophors. The Au_8 clusters are encapsulated in dendrimers (macromolecules with a treelike branched structure), forming stable nanodots, which are smaller than nanoparticles. In samples containing a range of cluster sizes, fluorescence was directly proportional to the relative abundance of Au_8, indicating that this octet alone is responsible for the blue emission. — JFU

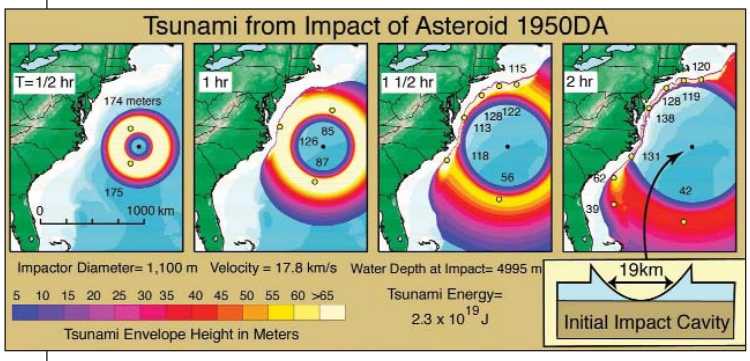
J. Am. Chem. Soc. 10.1021/ja035473v (2003).

PLANETARY SCIENCE

Blowing a Hole in the Ocean

Dedicated searches are locating and tracking all kilometer-sized asteroids in near-Earth orbit in order to assess and anticipate potential impact hazards. To date, only asteroid 1950 DA (1.1 km diameter) has been accorded any chance of hitting Earth with up to a 0.3% probability of colliding on 16 March 2880 (see Reports, 5 April 2002, p. 132).

Ward and Asphaug modeled the impact cavity and tsunami that would be created by 1950 DA traveling at 17 km/s into the Atlantic Ocean at 35°N and 70° W. The asteroid would blow a hole through the entire ocean to a depth of ~5 km and excavate the seafloor. Waves would propagate in a circular pattern; about an hour after impact, observers on the eastern shore of the United States would start to see small waves, which would increase in height to a maximum of about 100 m in another hour. Successive tsunamis would cause scouring of ocean sediments and submarine landslides, and possibly gas hydrate decompression. On the bright side, tsunami run-up on land would be limited to 4 km because the waves have short periods. Still, not be a good day to be at the beach. — LR



Geophys. J. Int. **153**, F6 (2003).

APPLIED PHYSICS

Stamping Out Polymer Lasers

Simplified fabrication and processing techniques for organic semiconducting polymers mean that realizing cheap integrated optoelectronic devices is feasible. However, most of the processes incorporate a high-temperature step, which usually leads to a deterioration of the optoelectronic properties of the polymer, limiting its performance. Lawrence *et al.* circumvent this heating problem by using a solvent-assisted molding technique to pattern the device structure directly. Fabricating a distributed feedback structure with micrometer-sized features in less than 2 min, they confirm the quality of the material by demonstrating lasing by optical pumping. The flexibility of the micromolding technique offers the ability to mass-fabricate a wide range of other photonic and optoelectronic devices. — ISO

Appl. Phys. Lett. **82**, 4023 (2003).

BIOMEDICINE

A Robust Revelation in Lupus

Systemic lupus erythematosus (SLE) is a potentially fatal autoimmune disease that affects multiple organ systems and is characterized by a range of symptoms, including kidney disease, arthritis, cardiopulmonary abnormalities, and skin photosensitivity. Autoantibodies against cellular macromolecules such as chromatin, phospholipids, and ribosomes have been identified in SLE patients, suggesting that the formation of immune complexes may lead to tissue inflammation and damage.

Xue *et al.* report that mice lacking an RNA-binding protein called Ro (a known SLE autoantigen) develop antibodies against ribosomes and chromatin. These mice display glomerulonephritis and skin photosensitivity reminiscent of the human disease even though their immune systems appear normal. Previous work in the frog *Xenopus* and worm *Caenorhabditis elegans* revealed that Ro may be a component of a ribosomal quality-control pathway in which misfolded 5*S* ribosomal RNA (rRNA) molecules are degraded before they become incorporated into ribosomes. In addition, Ro helps the bacterium *Deinococcus radiodurans* to withstand ultraviolet irradiation and *C. elegans* to withstand environmental stress. These authors propose that loss of Ro in mice may lead to incorporation of misfolded 5*S* rRNAs into ribosomes, resulting in the presentation of hidden epitopes to the immune system, the formation of antibodies to ribosomes, and the development of autoimmune disease. — OMS

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.0832411100 (2003).

CREDIT: S. WARD AND E. ASPHAUG