EDITORS' CHOICE

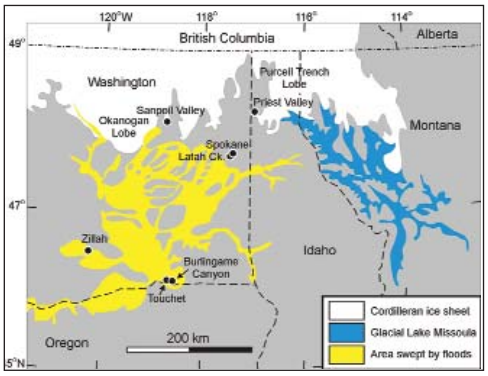
edited by Gilbert Chin

Flood deposits in Burlingame Canyon.

GEOSCIENCE

Recurrent Flooding

When an ice dam broke during the last deglaciation, torrential floodwaters from Glacial Lake Missoula, which was located in western Montana, surged across eastern Washington, creating the now famous "channeled scabland." Similar features have since been found near the former margins of receding glaciers throughout the Northern Hemisphere, and such flooding is recognized as a common, albeit extreme, process.



Whether the ice dam confining Lake Missoula was breached repeatedly has been debated, in part because the transitions between the layered floodwater deposits are subtle and hence it is not clear whether they represent scores of distinct events or the rhythmic sedimentation of just a few long-lived outflows. Clague *et al.* used paleomagnetic measurements and the demarcation of two volcanic horizons derived from Mount St. Helens preserved in the flood sediments to resolve this question. Their data imply that perhaps as many as 40 voluminous floods inundated the region over several thousand years. — BH

Geology **31**, 247 (2003).

CLIMATE SCIENCE

Historical Airs

Records of terrestrial paleotemperatures are difficult to assemble. Unlike marine environments, there is a lack of reliable proxies for temperature, and inferences must often be made based on modeling and inexact indices rather than accurately quantifiable parameters. This problem is acute in arid regions, making the reconstruction of past climate in Africa particularly challenging.

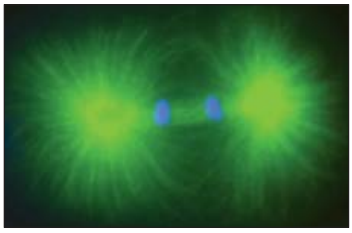
One of the promising approaches to determining terrestrial paleotemperatures is to measure the concentrations of dissolved noble gases in groundwaters. Because these gases display a range of temperature-dependent solubilities in water that varies with their masses, water temperature can be calculated by determining their concentrations. Beyerle *et al.* adopt a sophisticated version of this approach—by also measuring the stable isotope compositions of hydrogen and oxygen as well as ^{14}C—to compile a record of temperature and humidity for the Sahel in southwest Niger since the late Pleistocene. Soil temperatures more than 6000 years ago were 2° to 5°C lower than they are today, which is cooler than has been assumed. They attribute this partly to atmospheric cooling, but also to recharge during more humid climate phases that had increased vegetation and a reduced difference between soil and air temperatures. — HJS

Geophys. Res. Lett. **30**, 1173 (2003).

CELL BIOLOGY

When and Where to Cleave

As cells divide, they must place the two new nuclei into separate daughter cells. Cells precisely control the timing and positioning of cleavage (cytokinesis) in order to avoid the generation of anucleate and multinucleate daughters, but how animal cells specify the plane of division is not well understood. From their studies on *Caenorhabditis elegans* embryos, Dechant and Glotzer



In anaphase, microtubules (green) separate chromosomes (blue).

present evidence that the low density of microtubules between daughter nuclei (after spindle elongation has taken place) can signal where the cell will form a cleavage furrow. If the microtubule density remains high because of a reduction in chromosomal separation during anaphase, furrow formation is delayed. Therefore, not only is the mitotic spindle important for partitioning chromosomes to daughter cells, but after completing this job, it helps to specify when and where cleavage into daughter cells occurs. — SMH

Dev. Cell **4**, 333 (2003).

ECOLOGY/EVOLUTION

Molecular Latitude

Most groups of organisms obey latitudinal gradients in species richness, whereby numbers of species increase from the poles toward the equator. The reasons for these gradients remain contentious. One proposal is that increased temperature and solar radiation lead to faster growth, shorter generation times, elevated mutation, and faster molecular evolution, all of which should combine to produce more rapid rates of speciation. Bromham and Cardillo investigated this proposal using a comparative test of the rates of molecular evolution of mitochondrial and nuclear DNA in phylogenetically independent pairs of bird species from different latitudes. The phylogenies reconstructed from the sequence data indicated no statistically significant differences between rates of molecular evolution at different latitudes, arguing against the proposal that climatic factors directly influence the speciation rate in birds. — AMS

J. Evol. Biol. **16**, 200 (2003).

CHEMISTRY

Going for the Gold Cluster

Gold nanoclusters can exhibit much greater reactivity than the bulk metal, especially when they are supported on oxides that can transfer negative charge to the clusters. Their reactivity can also differ from that of platinum group metals. For example, the latter normally dissociate O_2 in oxidation reactions, whereas several studies indicate that the active species on gold clusters is molecular in character. To identify the activated species, Stolcic

CONTINUED ON PAGE 1629

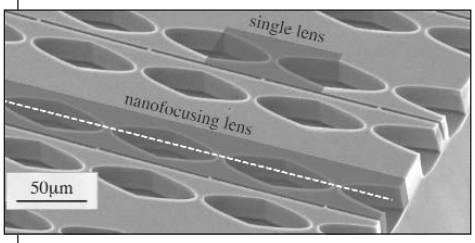
et al. have performed photoelectron spectroscopic studies of the interaction of mass-selected, gas-phase, gold cluster anions (Au_n^-) with O_2. At least for very small clusters (Au_2^- and Au_4^-), the photoelectron spectra show vibrational fine structure indicative of bound superoxo (O_2^-) and peroxo (O_2^{2-}) species, respectively. — PDS

J. Am. Chem. Soc. 10.1021/ja0293406 (2003).

APPLIED PHYSICS

X-rays Hit the Nanospot

Although recent developments in hard x-ray optics have enabled techniques such as scanning probe microscopy and microfluorescence tomography, improvement of the limited lateral extent of the x-ray beam, which typically is in the micrometer range, is desirable, particularly for applications in nanotechnology and for imaging small volumes of biological samples. Schroer *et al*. describe the realization of x-ray nanofocusing lenses fabricated in a diamond substrate. An array of planar refractive lenses is



Micrograph showing an array of x-ray lenses fabricated in diamond.

fabricated with 50 or 100 individual lenses aligned along a common optical axis, focusing the x-ray beam into a series of lines. Orthogonal placement of a second lens array behind the first then allows the x-ray beam to be focused in two dimensions to a spot. They show that x-rays can be focused to a spot size of 380 nm by 210 nm but expect to achieve even smaller dimensions with further optimization. — ISO

Appl. Phys. Lett. **82**, 1485 (2003).

IMMUNOLOGY

Nurturing a T Cell Brigade

The treatment of cancer by introducing tumor-fighting T cells into patients has seen some success for some types of malignancy. Generally, however, it has been difficult to produce enough such T cells and to maintain their in vitro reactivity within the patient.

In an attempt to overcome these shortcomings, Brentjens *et al*. transduced fresh human T cells with a chimeric antigen receptor (CAR) whose external domain recognizes CD19: a surface protein that is expressed in many B cell malignancies. In culture, these CAR^+ T cells efficiently killed CD19-bearing tumor cells, retaining this activity even after extensive expansion. Infusing these expanded T cells into immunodeficient beige mice resulted in the eradication of a previously engrafted Burkitt lymphoma. Successful ex vivo activation, expansion, and in vivo survival of transduced T cells required the cytokine interleukin-15 and the costimulatory surface molecule CD80. Finally, T cells taken from patients with chronic lymphoid leukemia, after modification with the same CAR, were capable of killing autologous tumor cells in culture, hinting that translation of this work to the clinic might be feasible. — SJS

Nature Med. **9**, 279 (2003).

NEUROIMMUNOLOGY

Remembrance of T-Shirts Past

The mysterious linkage between male body odor and female mate preference may finally have a molecular rationale, based on results presented by Loconto *et al*. and Ishii *et al*. One of the well-known loci at which mammals display enormous diversity is the major histocompatibility (MHC) locus, which governs immune responses and transplantation tolerance (or rejection). The MHC class Ia molecules are membrane proteins that bind antigenic peptides and present them to T cells. Another diverse protein family, more recently discovered, is that of the vomeronasal organ (VNO) receptors V1R and V2R, each of which is a family of 100 to 200 membrane proteins that have been shown in mice to be involved in detecting pheromones. Both groups document the coexpression of MHC molecules (of the class Ib type) and V2Rs in the basal layer of the VNO epithelium, with some neurons containing just one member of each family and with others containing multiple representatives. Although the logic of these expression patterns is not yet apparent, these data nicely complement earlier work describing the function of MHC class I molecules in neuronal development and plasticity. Loconto *et al*. also show that another habitué of the immune system, β2-microglobulin, is coexpressed in a complex with V2Rs and class Ib molecules, which is suggestive of a role in the establishment or maintenance of this combinatorial sensory code. — GJC

Cell **112**, 607 (2003); *Curr. Biol.* **13**, 394 (2003).

CREDIT: SCHROER *ET AL., APPL. PHYS. LETT.* **82**, 1485 (2003)

Recurrent Flooding

Science **299** (5613), 1627.
DOI: 10.1126/science.299.5613.1627a