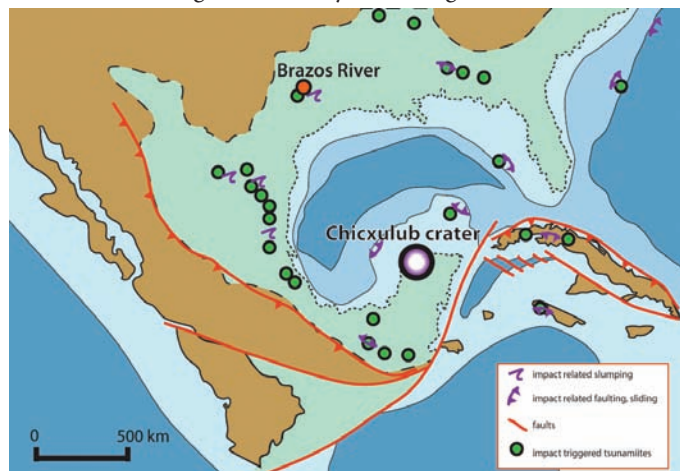




In This Issue

Global cooling following the Chicxulub impact

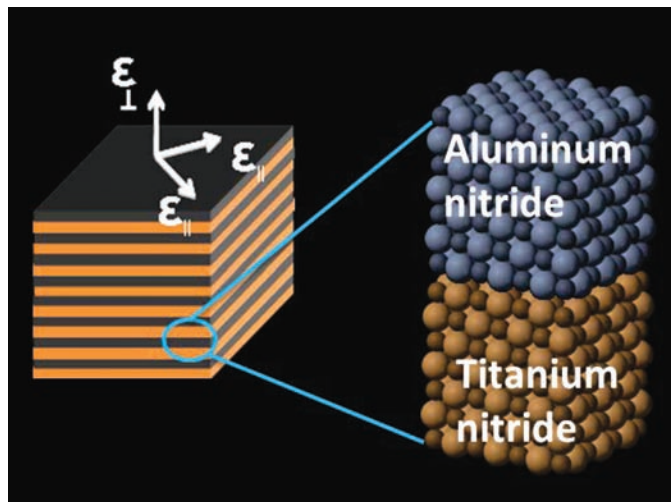
The impact of an asteroid in the Gulf of Mexico around 66 million years ago is thought to have caused a subsequent period of global cooling that contributed to the extinction of the dinosaurs, among other species. The cooling would have been caused by large quantities of dust and aerosols lofted into the air by the impact and the widespread wildfires that followed. Johan Vellekoop et al. (pp. 7537–7541) discovered evidence for postimpact global cooling in marine sediments from the Brazos River region of Texas. The sedimentary rocks of the same age as the Chicxulub impact contained coarse layers of broken shells—possibly traces of a postimpact tsunami—and anomalously high concentrations of iridium, generated from the vaporization of the asteroid. Applying a sea surface temperature proxy method to lipids preserved in the rocks, the authors found that sea surface temperatures following the impact likely fell by several degrees compared with preimpact temperatures. Some samples suggest temperature drops of as many as 7 °C, which may be a conservative estimate, the authors report, due to mixing of pre- and postimpact lipids in the sediments. The results lend support to the theory of an impact-generated winter as a potential contributing cause of the mass extinction at the Cretaceous–Paleogene boundary, according to the authors. — P.G.



A paleogeographic map of the Gulf of Mexico at the end of the Cretaceous period.

Superlattices as scaffolds for metamaterial fabrication

Metamaterials can help develop materials with unconventional optical properties by combining different components at sub-wavelength scale. Combining metal and dielectric components at nanoscale, for example, can produce metamaterials with desirable



Alternating layers of titanium nitride metal and dielectric cubic aluminum nitride form a crystalline metamaterial with high-quality optical properties.

functionalities. However, combining metal and dielectric components at nanoscale is challenging owing to a large mismatch in material properties. To alleviate this problem using unconventional metals instead of conventional noble metals, Gururaj Naik et al. (pp. 7546–7551) constructed a titanium nitride-based superlattice with ultra smooth layers as thin as 5 nm. The authors grew the superlattice epitaxially, such that crystalline layers were deposited on crystalline substrates. In order to satisfy the stringent requirements of epitaxial growth, the authors developed cubic aluminum scandium nitride as a dielectric material that grew as lattice-matched crystals on titanium nitride. Tests of the optical properties of the epitaxial superlattice showed behavior as a hyperbolic metamaterial in the visible range of light wavelengths. Tests also revealed that titanium nitride-based superlattices provided higher enhancements of material optical properties than gold- or silver-based metamaterials. The results suggest that epitaxial superlattices based on titanium nitride may lead to high-quality and high-performance metamaterial devices with adjustable optical properties. According to the authors, the development may enable experiments hampered by material and fabrication challenges. — P.G.

Costs of conflict between companies and communities

Communities often respond strongly to proposed developments by industries such as oil and gas or mining, which generate social and environmental risks for local populations. To quantify the costs of company–community conflict and understand how companies interpret such costs, Daniel Franks et al. (pp. 7576–



Image courtesy of Wikimedia Commons/Elbuenminero.

Yanacocha gold mine in Peru.

7581) interviewed 45 professionals in industries involved in natural resource extraction, examined 50 case studies of extraction projects worldwide involving prolonged conflict, and conducted 136 interviews for in-depth research in Peru. Case research revealed that the most common issues in dispute were environmental, such as water contamination or competition for natural resources. Interviewees cited project delays as the most frequent cost, noting that delays can cost roughly \$20 million per week for mining projects valued between \$3–5 billion. The highest costs were due to the value lost when projects could not be pursued. The results suggest that financial risks associated with conflict provide an incentive for companies to minimize environmental and social risk to local populations. Understanding the relationships between environmental, social, and business risk might help shape better outcomes for communities and companies, according to the authors. — P.G.

Long-term health risks of childhood bullying

Research suggests that bullying can negatively influence the psychological and social development of children. William Copeland (pp. 7570–7575) and colleagues investigated whether

childhood bullying can also affect children's physiological health. The authors interviewed 1,420 children from North Carolina, 90% of whom were white, 4% Native American, and 6% African American, between ages 9 and 16 about their experiences with bullying. Blood assays in the children for C-reactive protein (CRP), a marker of low-grade systemic inflammation in the body often associated with cardiovascular disease and metabolic syndrome, revealed that CRP levels for bullied children increased with the number of times they were bullied. A second set of blood assays at ages 19 and 21, after bullying had ceased, revealed that CRP levels remained twice as high in individuals that had been bullied as children than individuals who had bullied, whereas bullies had CRP levels lower than those who were neither



Image courtesy of iStockphoto/omgimages.

Bullying may affect long-term health.

bullied nor victims. The results suggest that bullied children may experience higher than normal levels of subclinical inflammation that can persist into adulthood, whereas bullies experience lower levels of inflammation than children who were neither victims nor bullies. According to the authors, a child's role in bullying might serve as either a risk or a protective factor for adult low-grade inflammation, which may negatively affect long-term health. — J.P.J.