GEOCHEMISTRY

Geologists Find Vestige of Early Earth—Maybe World's Oldest Rock

Really old stuff is rare on Earth. The planet's brand of violent geology has just been too dynamic to preserve much from its earliest days. Formed 4.567 billion years ago, Earth has yielded 4.3-billion-year-old mineral grains and 4.0-billion-year-old rocks that hint at how a ball of primordial debris evolved into a crusted-over, largely ocean-covered abode of life.

So geologists keep searching the oldest, most brutally battered terrains for more traces of earliest Earth. On page 1828, a group reports the discovery of rock in northern Quebec on Hudson Bay that records the existence of the earliest crust. The Canadian rock may also be the oldest known rock by 300 million years.

Given how beaten up the oldest rocks are, geologists often fall back on atomic-scale records preserved in the isotopic and elemental composition of the rocks. Geologist Jonathan O'Neil of McGill University in Montreal, geochemist Richard Carlson of the Carnegie Institution of Washington's Department of Terrestrial Magnetism in Washington, D.C., and colleagues analyzed isotopes of the elements samarium and neodymium from the Nuvvuagittuq greenstone belt of northern Quebec. These isotopes can be used to trace geologic processes because some isotopes are stable and don't change no matter how many eons pass, whereas some steadily decay radioactively into other, more stable isotopes. Different elements behave differently when rock partially melts; some tend to concentrate in the melt, while others remain behind.

Delving into the samarium and neodymium of volcanic and altered sedimentary Nuvvuagittuq rock, O'Neil and his colleagues found isotopic signs that the rock could represent the oldest section of crust on Earth. Geochemists had already found rock in Greenland that, according to its isotopes, had been derived from the earliest mantle rock. But by 4.3 billion years ago, that mantle rock had partially melted to yield crustal rock, so researchers had fingered "protomantle" by analyzing Greenland rock derived from it. But where was the "protocrust" that must have been formed as the protomantle formed?

O'Neil and colleagues think they now have such protocrust in Quebec. The Nuvvuagittuq rock has the opposite neodymium isotope signature of the Greenland rock's protomantle. Either this rock is a 2-kilometer-long sliver of protocrust resembling today's iron-rich ocean crust, or it was derived from such protocrust. "That's a first," says geochemist Albrecht Hofmann of the Max Planck Institute for Chemistry in Mainz, Germany. "It's an heroic effort" to measure the subtle isotopic variations involved.

Older than dirt. Rocks by Hudson Bay may date back to when Earth first separated its primordial stuff into mantle and crust.

CREDIT: JONATHAN O'NEIL/MCGILL UNIVERSITY

The group goes further, drawing on the clocklike radioactive decay of samarium-146 to calculate an age of formation of the Nuvvuagittuq rock of about 4.3 billion years. If accurate, that age would mean they have the protocrust itself, not just something derived from it. That rock would be the oldest rock known, approaching the age of individual zircon mineral grains from western Australia that tell of a wet and weathered world soon after Earth's origin. The new age "is exciting," says geochemist Mukul Sharma of Dartmouth College, but uncertainties remain about details of the rocks' formation that bear on its isotopic age. "There's a lot more work that needs to be done," he says, before a new world's most ancient rock can be crowned.

–RICHARD A. KERR

EPA Nixes Perchlorate Standard

After a multiyear bureaucratic fight, the U.S. Environmental Protection Agency (EPA) has decided not to regulate a toxic rocket fuel component leaching into the nation's drinking water. The proposed ruling explains that requiring the cleanup of perchlorate, which is polluting areas near U.S. military sites, would provide no "meaningful opportunity for health risk reduction." It's a controversial decision. "There is substantial evidence that this chemical needs to be regulated," says toxicologist Melanie Marty, chair of EPA's child health advisory committee. In a 2006 letter to EPA, Marty cited studies that suggest current perchlorate levels at hundreds of U.S. sites could "result in exposures that pose neurodevelopmental risks" to infants.

–ELI KINTISCH

Scientists Go Nano a Mano

Last week, the U.S. Environmental Protection Agency and the National Science Foundation jointly funded two centers to track the environmental implications of nanomaterials for 5 years. A $24 million center led by the University of California, Los Angeles, will perform cell-based studies to find materials that pose the greatest potential risks. The other center, awarded $14 million and led by researchers at Duke University in Durham, North Carolina, will track the effects of nanomaterials on organisms as they move through tightly controlled ecosystems in labs. Andrew Maynard, a nanotechnology expert with the Woodrow Wilson International Center for Scholars in Washington, D.C., says the work "is an important step." But he would prefer to see a "robust federal risk research strategy" to systematically evaluate dangers from all potential nanomaterials. **–ROBERT F. SERVICE**

Gray Wolf Regains Protection

The U.S. Fish and Wildlife Service has put the gray wolf back on the endangered species list. The listing conforms to a U.S. district court order issued in July (*Science*, 25 July, p. 475). There had been speculation that the government might appeal the ruling, which came after the Natural Resources Defense Council and other groups challenged a February decision by the agency to delist the Northern Rockies wolves. Now scientists with the council say they're cautiously optimistic about the wolf's chances. Two thousand wolves roam the region, they calculate; more than 2500 are needed for proper genetic mixing.

–ELI KINTISCH

Published by AAAS