New Record for World's Oldest Rocks

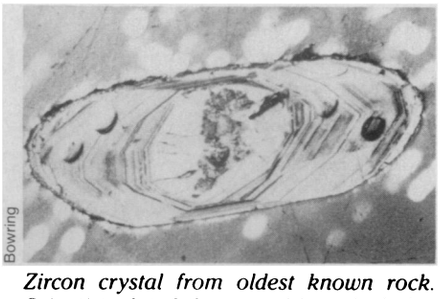
Researchers have identified the Earth's oldest known rocks amid the remote lakes and tundra of northwest Canada. Dating back 3.96 billion years, the rocks should help scientists construct a picture of the planet's nebulous early history, which began about 4.5 billion years ago.

"The reason this is significant is that there is a lot of conjecture about what went on in the early Earth, but very little data," says Samuel A. Bowring of Washington University in St. Louis, who found the rocks along with colleagues from the Canadian Geological Survey while exploring the geology near Canada's Great Slave Lake. Until now, geologists recognized rocks from western Greenland as the oldest known formations. These are about 100 million years younger than the newly found rocks from the Slave geologic province.

Bowring and his co-workers dated the rocks by examining the relative amounts of uranium and lead locked within tiny zircon crystals embedded in the rock. "The beauty of zircons over any other dating method is that each grain is like a little time capsule," he says. Bowring, with geochronologists Ian S. Williams and William Compston from the Australian National University in Canberra, will report the dating results in the November GEOLOGY.

When zircon crystals form as molten rock begins to cool, they lock small amounts of uranium into their structure, but very little lead gets into the crystal. Uranium decays radioactively into lead, so lead levels build up inside the crystal. If subsequent geologic forces do not severely deform the zircon, then lead cannot appreciably leave or enter the crystal. By measuring the ratio of uranium to lead within the crystal, geologists can use the steady radioactive decay as a clock to date the crystal.

After preliminary experiments in the United States indicated these rocks might be quite old, Bowring took them to Australia for analysis in an extremely sensitive, one-of-a-kind machine called SHRIMP (for sensitive high-mass-resolution ion microprobe). Whereas traditional techniques require analyzing most or all of the zircon crystal, SHRIMP allows researchers to single out tiny sections for close examination. The added resolution is important because lead can leak out of zircons through cracks and bubbles, making the rock seem younger than it is. With the ion probe, researchers can search for the best-preserved section of the crystal.



Bowring

Zircon crystal from oldest known rock. Scientists dated the crystal by calculating how much of its uranium had radioactively decayed into lead. To measure the ratio of uranium to lead, they shot an ion beam at the surface, vaporizing a tiny part of the crystal. Pits show where ion beam hit.

The machine uses a powerful beam of ions to vaporize a small bit of the crystal, then sends the vapor through a mass spectrometer that separates the different elements in it. Each time the beam hits, it vaporizes about two-billionths of a gram of material.

Though they come from the oldest known rocks, the Canadian crystals themselves are not the oldest remnants of the Earth ever found. Researchers have dated Australian zircon crystals at almost 4.3 billion years old. However, those crystals were located in much younger rock, indicating they had eroded from their original rock billions of years ago and were then incorporated into newer rock. Although geologists are searching for this "parent" rock, no one knows on which continent it might be found or even whether it still exists, Bowring says.

According to Joseph L. Wooden of the U.S. Geological Survey in Menlo Park, Calif., the Canadian find is noteworthy because the zircons sit in original rock. "It's very important to actually have [the original] rocks because we can get much more insight into how crustal rock was being formed at that time," he says.

Earth scientists believe the first crust formed from the lighter elements that rose out of a molten or partially molten mantle. Basaltic oceanic rocks – such as the ones that erupt from Hawaiian volcanoes – closely resemble mantle material, so basalt probably would have formed most of the earliest crust, both on the continents and under the oceans. When later tectonic activity melted and remelted the basaltic crust, granites would have formed out of the original material.

Today, basaltic rocks still line the world's ocean basins, but granite-type rocks form most of the crust on the continents. The old Canadian rocks are granitic, indicating the Earth was forming "normal" continental crust back around 4 billion years ago, Bowring says.

"The thing that is remarkable is that the oldest [known] rocks are in fact very highly evolved rocks," says William R. Van Schmus of the University of Kansas in Lawrence. Granites could not have been the first crust; they must have evolved from earlier crustal rocks, he notes.

Researchers have used SHRIMP to date some 3.85-billion-year-old rocks from Antarctica and have located slightly younger rocks in the United States, Africa and elsewhere. Yet few rocks on Earth date back beyond 3.7 billion years. Bowring says this could mean that Earth did not start producing much continental crust until after that time, or that it has recycled the rocks made before then.

– R. Monastersky

Drug duo takes on deadly colon cancer

A double drug treatment, given soon after surgery to patients with advanced colon cancer, shaves the risk of dying from cancer recurrence by one-third, according to two new reports. The therapy is the first significant advance to help people with late-stage colon cancer fight the specter of a recurrence. Colon cancer can recur when surgeons remove all visible malignancies but can't get microscopic cancer cells that have spread to other parts of the body.

"Although this therapy does not cure all patients, it has significantly improved the outlook for patients whose surgically removed colon cancer was at an advanced stage," says Samuel Broder, director of the National Cancer Institute (NCI), which sponsored both studies. Broder announced the findings this week at a press conference in Bethesda, Md.

In the first study, Charles G. Moertel of the Mayo Clinic in Rochester, Minn., and his colleagues studied 401 people with colon cancer. They randomly assigned patients to a group receiving no further treatment after surgery or to groups receiving additional treatment – either a veterinary drug known as levamisole or a combination of levamisole and 5-fluorouracil, a federally approved anticancer drug. After five years, the researchers found that the patients on the combination regimen had fewer cancer recurrences than did patients receiving no drugs after surgery. In cases where the cancer did reappear, these patients also experienced longer delays before recurrence. Levamisol alone offered only minor advantages compared with no treatment.

Moertel's team discovered a significant survival advantage for people with Dukes' C colon cancer, in which the malignancy has spread to lymph nodes.