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EARTH'S OLDEST WATER

A record for the oldest water found on Earth was set in 2013 as researchers found several kilometers deep in a Canadian mine that produces copper, zinc and silver. The water was found bubbling up from a shaft, rather than trapped in solid rock (as is usually the case), and estimated to be between 1.5 and 2.0 billion years old. Considering that scientists place the planetary age at about 4.5 billion years, this water was probably produced and trapped in the Earth's crust as it cooled and could support life. Traces of sulfate and other simple ions in the freshwater suggest that ancient microbes were present and producing fluids over geologic timescales. By comparison, perhaps the world's oldest fossils (tube worms) may have been formed almost 4.3 billion years ago near thermal vents on the ocean floor, where seawater (comprising the entire planet surface) and nutrient-rich magma were mixed.

DEUTERIUM

Water is composed of two atoms, hydrogen and oxygen, that exist in several varieties depending on the number of neutrons in their nucleus. These "isotopes" are present in water at ratios that reflect its source, its planetary journey and its interactions with earthly life forms. Deuterium is a stable (non-radioactive) isotope that represents only 0.02% of the hydrogen in water and was likely formed early in the universe's history. Because the lighter and more common isotope of hydrogen is preferentially utilized by biological systems, low-deuterium drinking water has been used to treat specific health issues in humans. By contrast, deuterium-rich water is preferred in nuclear fission reactors because it more effectively slows down the reactions. Recently, an ultra-dense form of deuterium has been created that can serve as fuel for the safer nuclear fusion reactors, which produce only helium and hydrogen as byproducts.

NUISANCE FLOODS

The term "nuisance flooding" is being used to describe that caused by high tides and routine rainfall events with the accompanying waves along coastal areas of the southeastern USA and elsewhere in the world. The causes of this flooding have been attributed to the combination of land subsidence and sea level rise. Whereas global climate change and sea level rise are now well correlated, it turns out that over-pumping groundwater aquifers and storing water behind dams results in a slight subsidence of the surrounding land. The land only subsides a few millimeters per year, but the cumulative effect on regions with elevations just above sea level is enough to cause chronic flooding (exclusive of major storm events). Since the beginning of the industrial age, humans have engaged in activities that redistribute water on the surface of the planet, affecting everything from watershed dynamics to the spin of the earth.

WATER COMPUTER

The digital age is dependent on a variety of otherwise inert materials such as silicon dioxide (quartz) and may soon turn to black phosphorus or carbon nanotubes to design computers of the future. Water is a substance one rarely associates with computing, although bioengineers have now designed a computer that utilizes synchronized droplets of water as bits of information within a magnetic field that determines the direction of movement and interactions of the droplets. A water computer typically takes advantage of so-called microfluidics, whereby nitrogen bubbles or magnetics direct the flow of water through tiny tubes. The direction of flow then transmits information. Although water computers cannot compete with their conventional counterparts in terms of speed, the former have an advantage of controlling matter so they can be used in the laboratory to control and automate experiments.