

Buried alive: Half of Earth's life may lie below land, sea

March 9 2010, By Robert S. Boyd

While astronomers scour the skies for signs of life in outer space, biologists are exploring an enormous living world buried below the surface of the Earth.

Scientists estimate that nearly half the living material on our planet is hidden in or beneath the ocean or in rocks, soil, tree roots, mines, oil wells, lakes and aquifers on the continents.

They call it the "subsurface biosphere," a dark world where the sun and stars don't shine. Some call it Earth's basement.

"Earth's [habitable zone](#) extends to depths of hundreds or thousands of meters," Katrina Edwards, a microbiologist at the University of Southern California, told a December conference of the American Geophysical Union in San Francisco. "The organisms that live in this environment may collectively have a mass equivalent to that of all of Earth's surface dwellers and may provide keys to solving major environmental, agricultural and industrial problems."

For example, geologists are considering whether to store some of the world's excess carbon dioxide, a major [greenhouse gas](#), in a worldwide network of crevices below the seafloor.

Scientists say research on "intraterrestrial life" complements astronomers' hunt for "[extraterrestrial life](#)" around other stars and planets. The search for E.T. starts at home.

"Much that we do in our work to discover and understand the deep biosphere has relevance to the origin and search for life elsewhere in the universe," Edwards said by e-mail. "Fundamentally, this is all about life detection. ... Our inner space is a natural testing ground for outer space."

To advance their understanding of subsurface life, marine geologists are about to launch three drill ship expeditions to punch holes in the seafloor and implant long-term scientific "observatories" linked by cable and satellite to onshore laboratories.

"We'll be sitting in front of a fire hose of data," said Andrew Fisher, a geophysicist at the University of California in Santa Cruz.

In July, the international Integrated Ocean Drilling Program will send its high-tech drill ship, the JOIDES Resolution, to the Juan de Fuca Ridge off the Canadian coast in the Northeast Pacific. In October, the ship will head for the South Pacific Gyre, a vast rotating pool of water between New Zealand and Hawaii. Next year, it will pass through the Panama Canal to drill in North Pond, an undersea valley on the Mid-Atlantic Ridge, a chain of seamounts between North America and Africa.

Fisher, the chief scientist on the Juan de Fuca expedition, said this summer's drilling would complete a network of six observatories under the North Pacific seafloor.

Dyed fluids will be pumped into selected places so scientists can follow the flow of water and microbes through a maze of subsurface "plumbing." These deep oceanic aquifers are thought to contain as much water as all the rivers on Earth.

"It'll be like determining how your home plumbing works by sampling the water at the taps," Fisher said.

Subsurface biosphere research may shed light on the origin of life on Earth and the possibility of life on other planets.

"The conditions we see in the sub-seafloor are similar to what conditions may have been on the early Earth," Fisher said. Similar conditions may exist or have existed on Mars or the moons of Jupiter.

"It is highly likely that if Mars supports life, it will also be in a deep biosphere where temperatures are high enough to allow liquid water," John Parnell, a geologist at the University of Aberdeen, Scotland, told a conference of planetary scientists last week in The Woodlands, Texas.

Steven D'Hondt, an oceanographer at the University of Rhode Island, will lead the expedition to the South Pacific Gyre. The JOIDES Resolution will drive seven holes in the seafloor to study microbial [life](#) there.

One objective will be to determine whether deep sea chemicals, such as hydrogen and sulfur, that don't depend on energy from the sun on Earth's surface can nourish subsurface microbes.

Edwards, the USC microbiologist, expects to lead the 2011 expedition to North Pond, in the Atlantic, where four holes will be drilled. One goal is to find out whether microbes in the Atlantic are different from their Pacific Ocean cousins, or whether the same creatures travel around the globe.

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