Professor looks for life in and under antarctic ice

August 31 2007

Antarctica is home to the largest body of ice on Earth. Prior to approximately 10 years ago, no one thought that life could exist beneath the Antarctic ice sheets, which can be more than two miles thick in places, because conditions were believed to be too extreme. However, Brent Christner, assistant professor of biological sciences at LSU, has spent a great deal of time in one of the world's most hostile environments conducting research that proves otherwise.

Christner's discoveries of viable microbes in ancient ice cores and subglacial environments coupled with the realization that large quantities of liquid water exist beneath the Antarctic ice sheet have changed the way biologists view life in Antarctica.

"More than 150 lakes have been discovered underneath nearly two-and-a-half miles of ice in Antactica," said Christner, "and most of these bodies of water have likely been covered by ice for at least 15 million years. The environmental conditions in the deep cold biosphere are unlike anything on the Earth's surface and this represents one of the most extreme habitats for life on the planet."

A timeframe of up to one million years is required for microbes in the atmosphere to be transported through the ice sheet and enter an Antarctic subglacial lake. Even though cells are preserved in the ice, the question of how the DNA of these organisms remains unscathed over such long periods of apparent metabolic inactivity still remains.

According to Christner, there are two possible explanations of how these microbes could survive frozen for millenia. Firstly, the microbes may be dormant in the ice and possess “very effective repair mechanisms that are initiated when the cells are introduced to a growth situation,” he said. Given enough time, dormant cells – without active DNA repair mechanisms – would eventually incur a lethal level of radiation-induced damage from natural background sources in the ice.

Alternatively, Christner suggests that the microbes may stay metabolically active while entrapped in the ice, giving them the ability to repair damage as it occurs. “If this is the case, these microbes may be essentially immortal when frozen – that is, if a continuous energy supply was available,” he said.

Christner’s current laboratory research has shown that glacier microbes are capable of metabolic activity when frozen down to -20 degrees Celcius. “Our experiments have revealed the potential for microbes to metabolize under frozen conditions, but we still lack the ‘smoking gun’ which proves this occurs in nature. We are now taking what we learned in the lab at LSU and using it to design experiments that address this question in real Antarctic ice samples,” he said.

In collaboration with research colleagues from Montana State University, Christner and two members of his laboratory will deploy to Antarctica in October 2007. Shawn Doyle, LSU senior and microbiology major, will accompany Christner, staying through January 2008. “I interviewed students based on their academic record and experiences,” said Christner. “We’re looking for more than a lab rat, because, as you might imagine, Antarctica presents various challenges for doing science.” He is currently looking for a Ph.D. student to join the research team and conduct field work during the 2008-09 Antarctic season.

“The implication of our research is that the large ice sheets of

Antarctica, which make up 70 percent of the planet's fresh water reserves, may represent active biomes, substantially expanding the known boundaries for life on Earth," said Christner. "Terrestrial glacier environments provide analogues to address questions relevant to the search for past or present microbial life in extraterrestrial ice on planets and moons in our solar system. Based on what we now know about the tenacity of life in Earth's deep cold biosphere, microbial life surviving and persisting in ice on Mars or Europa is not that much of a stretch."

Source: Louisiana State University