Oceanographers develop method for measuring the pace of life

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(PhysOrg.com) -- Life deep in the seabed proceeds very slowly. But the slow-growing bacteria living many meters beneath the seafloor play an important role in the global storage of organic carbon and have a long-term effect on climate.

A team of scientists from Aarhus University (Denmark) and the University of Rhode Island have developed a new method for measuring this slow life deep down in the seabed. Their findings were published last week in the journal *Nature*.

According to URI Oceanography Professor Arthur Spivack, the relative abundance of amino acids that are mirror images of each other in subseafloor sediment reflects the activity of microorganisms. The research team used this signature to calculate how active microorganisms are in the deepest layers of the seabed.

The deep seafloor samples were collected during an international drilling program led by the URI and Danish researchers. Advanced laboratory techniques were used to obtain the data. The researchers found that the metabolism of organic carbon takes place at a much slower rate in the deep seabed compared with all other known ecosystems.

“This study goes far beyond previous studies by showing that microbes in subseafloor sediment replace their biomass thousands of times more slowly than microbes in the surface world,” said URI Oceanography Professor Steven D’Hondt. The mean generation time of bacterial cells

in the sediment is correspondingly long – 1,000 to 3,000 years. In comparison, the bacteria that have previously been studied in the laboratory or in nature typically reproduce in a number of hours.

“Seventy percent of our planet is covered by ocean, which means that seventy percent of the planet is made up of seabed consisting of sediment that stores old organic matter,” said Aarhus University Associate Professor Bente Lomstein. “In some places the deposits are more than one hundred meters thick. Several percent of the total living biomass on Earth is actually found in the mud in the seabed. The bacteria in the seabed convert the carbon of organic matter to CO2, and if we add it all up, the metabolism down there plays a crucial role in the global carbon cycle, even if it happens very slowly.”

One reason for the slow pace of life in the seabed is the challenging environment the bacteria lives in.

“Extremely high pressure, total darkness and very little nutrition – those are the conditions under which microorganisms live in the seabed,” added Alice Thoft Langerhuus, another Aarhus University researcher. “At the bottom of the deep ocean, the pressure reaches several hundred atmospheres.”

The research team has also shown how many of the bacteria survive under such extreme conditions. The scientists succeeded for the first time in demonstrating that there are just as many dormant cells as there are active ones. The dormant bacteria have formed endospores, which have a solid shell to protect themselves against the harsh environment.

The researchers said that their new method for calculating the pace of life in the seabed can also be used to measure the pace of life in other ancient environments with extremely low biological activity, like permafrost soils.

Provided by University of Rhode Island