Professional Fasters Deep Under the Sea Floor

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A freshly drilled core arrives on deck. Gas masks protect the scientists on the research ship "Joides Resolution" from rising hydrogen sulphide. Image: ODP Leg 201 Shipboard Scientific Party

An international team of researchers from the USA and Germany has published an explanation for life in the Deep Biosphere in the magazine *Science*. Using a bunch of the latest technologies from biogeochemistry, molecular biology and microbiology, the scientists collected a wide range of samples from the bottom of the sea. After intensive analysis, Bo B. Jorgensen and Steven D'Hondt have now published a model with which they explain that microorganisms might survive due to the natural radioactivity deep under the sea floor.

It is estimated today that between 10 and 50 percent of all the biomass

on the Earth is found deep below ground. Researchers working with Steven D'Hondt from the University of Rhode Island, USA, and Bo B. Jørgensen from the Max Planck Institute for Marine Microbiology in Bremen have confirmed this in the course of the Ocean Drilling Program.

On a voyage on the research ship "Joides Resolution" they found life up to 400 meters below the sea floor. Tests revealed that the drilled cores contained living microorganisms; contamination was ruled out. In the upper layers of sediment, the researchers counted up to 100 million unicellular organisms per millilitre; deeper, in the 35 million year old sediments on the Earth's crust, they still found one million microorganisms. This is a puzzle for scientists: only the upper layers of these deposits are in contact with the water - so where does the energy to provide life in the depths of the sediment come from?

Taking as a basis the energy sources in the deposits that are available to the cells in the form of organic carbon compounds, it is possible to calculate that the cells could only divide every thousand years. This extremely long period for reproduction cannot be reconciled with current understanding of living cells.

Jørgensen and D'Hondt are now proposing, on the basis of their data, a process which could represent an alternative source of energy for life deep under large sections of the Pacific - natural radioactivity. Water is broken down by radioactive radiation, which arises during the decomposition of naturally occurring potassium, thorium and uranium isotopes. This process (radiolysis) creates hydrogen and oxygen. Estimates of the energy balance show that this process can supply sufficient energy for the microorganisms. This would make life forms in the Deep Biosphere independent of the processes on the Earth's surface. The authors point out that an exotic habitat like this could also have developed on other planets, far away from any suns.

In December 2006 the researchers will be taking the drilling ship "RV Roger Revelle" to the South Pacific. There, far away from the continental shelves, the quantity of carbon compounds which could serve the microorganisms as a basis for life is very low. This makes the researchers all the more curious about the sediment samples from the bottom of the sea.

Citation: B.B. Jørgensen and Steven D´Hondt, A Starving Majority Deep Beneath the Seafloor, *Science*, 10th November 2006

Source: Max-Planck-Institute for Marine Microbiology