Opening windows to the origins of life

Lovley details discovery of iron-eating bacteria

By Elizabeth Luciano
News Office staff

Microbiologist Derek Lovley has made a discovery which opens a window to understanding how life began on Earth. Lovley has determined that certain kinds of microorganisms, which live several miles below ground, can use iron to metabolize their food.

The findings are reported in the Sept. 3 issue of the journal Nature, and will be featured in an upcoming segment of the television show "Discover Magazine," on the Discovery Channel. Lovley, head of the Microbiology Department, studies unusual forms of anaerobic microorganisms: in other words, bacteria that transform their food into energy without using oxygen.

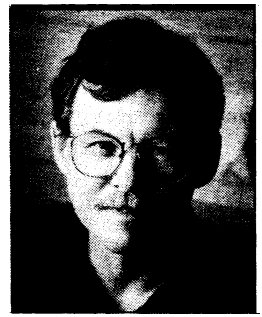
"The research helps us to understand life on Earth a little bit better," Lovley said, "but it also has a practical side."

His previous research has demonstrated that microorganisms that can grow on iron can be used in treating contaminated groundwater. The microorganisms use petroleum contaminants, such as benzene, as food, and literally eat away at contamination. These organisms can also remove toxic metals such as uranium and chromium from contaminated waters. His most recent findings focus on "hyperthermophiles": literally, those who love hot temperatures. Hyperthermophiles are the organisms most closely related to early forms of life, from which modern bacteria, plants, and animals have descended, Lovley said.

It was previously believed that some of the first microorganisms used sulfur to grow. But geologists noted that sulfur did not exist in the proper form on early Earth. There was, however, abundant iron, so Lovley set about determining whether iron could serve as an energy source for these early bacteria.

"You can't go back three billion years, but you can study these hyperthermophiles, which are the modern organisms most closely related to early life," said Lovley.

Studying seven species of hyperthermophiles, he determined that every single one could use iron to metabolize its food. This lends weight to the theory that iron was essential for the growth of early life on Earth, according to Lovley. One type of hyperthermophile in particular, thermotoga, used iron in a very central way, and sulfur in a very trivial way,



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professor of Microbiology

suggesting that iron was more central to the metabolism of early organisms than sulfur. All of the hyperthermophiles converted iron oxide to the magnetic mineral, magnetite, during their growth on iron.

This is significant because geologists have found large accumulations of magnetite on early Earth. Furthermore, magnetite found deep below the Earth's surface and in a Martian meteorite discovered in Antarctica has been thought to provide evidence for the possibility of life existing in these extreme environments.