Researchers discover key to spurring methane conversion

By Paula Hartman Cohen
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Derek Lovely, head of the Microbiol-ogy Department and graduate student Robert T: Anderson have found that bacteria living just below the earth's surface can be coaxed to rapidly convert oil to methane gas in oil-rich soil.

Their findings, spelled out in an article in this week's issue of Nature, have important implications for the petroleum industry, according to Lovley.

Petroleum engineers often hit pockets of methane when exploring for oil. These natural gas pockets generally are contiguous to oil reserves, where they can pose serious fire and explosion hazards for oil explorers. According to Lovley, specialized microorganisms that live deep in the earth break down oil to its simplest form, and the result of that process is what is called "natural gas."

Last summer, Lovley and Anderson examined the site of a contaminated aquifer where crude oil had spilled, 30 feet below the surface of the earth near Bemidji, Minn. With the help of a $325,000 grant from the National Science Foundation's Life in Extreme Environments Program, the two were studying anaerobic metabolic processes of microbes living in and around the oil spill. The contamination had changed the composition of the microbial community from what was normally found in the Minnesota soil to something more like what would be found near oil reservoirs. Unlike soil found much deeper in the earth, however, there were no sulfates in this soil. Until Lovley and Anderson's study, sulfate was thought to be a necessary ingredient in the process microbes use to break down oil.

The researchers incubated the sediments in the laboratory under conditions that mimicked those found in the subsurface of the earth. Surprisingly, as soon as Lovely and Anderson added the radiochemical hexadecane with a carbon 14 tracer to the sediment, methane gas carrying the carbon 14 isotope was produced "without a lag." The two concluded that the microbes in the soil were converting the hexadecane and other oil components in the soil to methane gas, in the same way deep-dwelling microbes might complete the methane process naturally.

"We found that, contrary to what **was previously believed,** it's not necessary to have sulfate present in order for microbes to produce methane from oil. This is important because significant amounts of sulfate are not usually found in most oil reservoirs. This finding is very useful, with a potential for widespread application to the petroleum industry," says Lovley. "In some cases it might be beneficial to use microorganisms to convert the oil in reservoirs to methane because methane is easier to extract than oil.

"When we better understand the conditions under which microorganisms convert oil to methane, we should be able to better predict where explosive deposits of methane will be located. This should make oil exploration a bit safer."