Group of Microbes Change Dissolved Gold to Solid

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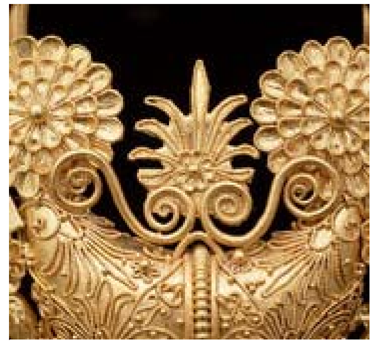

Detail of Ancient Gold Earring

Although a study has found that some microbes are able to change dissolved gold into a more metallic form, using them to harvest gold isn't likely to be cost-effective.

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Breathing is a rich experience for a group of unusual microbes that typically live deep beneath the sea.

A microbiologist has found that microscopic organisms known as extremophiles breathe in dissolved gold and out comes the stuff of gold rings, necklaces, and earrings. The finding may explain how some gold ore deposits formed.

Ten years ago Derek Lovley, a microbiologist at the University of Massachusetts in Amherst, discovered that many microorganisms derive their energy by breathing in dissolved forms of toxic metals, such as uranium and cadmium, and converting them to solids.

"They use metals like we use oxygen," said Lovley. "It is the way they get energy."

Technology developed from that discovery is widely used today in pollution cleanup. Certain microbes are used to separate toxic metals from contaminated water and soil. The separated metal can then be scooped up and removed.

Electron Transfer

After the earlier finding, Lovley and his colleagues wondered if microorganisms that thrive in environments where dissolved gold is found, such as hydrothermal vents and hot springs, could convert dissolved gold to solid gold.

"We know they can reduce iron naturally and radioactive contaminants," he said. "What about gold? It has an oxide state and a reduced state."

In the laboratory, the researchers placed iron-reducing microbes in a gold solution similar to that found in a hydrothermal vent deep in the ocean. As they suspected, the microbes rapidly converted the gold from the dissolved form to a more valuable, insoluble metallic form.

The microbes do this by transferring electrons (negatively charged particles) to the dissolved metals. That process, in turn, removes the non-metallic elements—leaving behind solid deposits.

"When electrons are transferred onto the soluble gold it changes its state from ionic gold, Au^{+3}, to metallic gold, which has no charge and is insoluble," said Lovley.

Gold Deposits

Microorganisms could be responsible for the formation of some gold deposits, Lovley suggested. Traces of gold found in sediment in the southeastern United States, for example, may have been formed on the bottom of the ocean, near hydrothermal vents, millions of years ago.

Since the research was published in the July issue of Applied and Environmental Microbiology, several gold miners have approached Lovley to inquire about using the microbes in their operations.

Lovley isn't encouraging. Although dissolved gold is found in all water, even seawater, the use of these microbes to harvest gold does not make economic sense, he said. "You couldn't use this process to harvest the gold from the ocean. The cost in pumping the water would be more than how much gold you could recover," he said. The gold particles excreted by the microbes are so tiny it would take about a million microbes to produce a gram of solid gold.

Nonetheless, the gold industry thinks the research is worth watching, said Paul Bateman, executive director of The Gold Institute in Washington, D.C.

"Anything that will increase the yields in production at low cost would be of interest, but this is in the early stages of experimentation," he said. "There could be at some point an application where we use microbes like this to capture some gold particles lost in the processing of gold."

The new research finding, Lovley noted, is another line of evidence that microbes play a large role in formation of the environment. Previous research in his lab showed that massive accumulations of magnetite created by iron-reducing microbes during the pre-Cambrian period are now important deposits of iron ore.

"I'm not surprised that microbes are playing a role here, too," said Lovley. "It is interesting how research in one area can lead to different corners. That is the exciting thing about science."