Researchers Probe How Microbes Speed Up Acid Production at Mining Sites

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The chemical processes involved in mining that lead to widespread acidification of water bodies and deposition of heavy metals have long puzzled scientists. In mined soils, microbes chemically react with pyrite to speed the production of sulfuric acid. Stanford researchers who studied this process wanted to understand how the activity of the microorganisms controls the chemistry on mineral surfaces, and how that chemistry in turn controls the activity of the microorganisms. Specifically, they wanted to find out what kinds of iron species and precipitates can be found on microbe-treated pyrite surfaces.

They found that the microbes coat the pyrite surface with chemicals that dramatically speed up oxidation and production of sulfuric acid instead of protecting the surface from oxidation, as was previously expected.

Co-principal investigators Scott Fendorf, Gordon Brown, and Alfred Spormann grew *Thiobacillus ferrooxidans* and *Thiobacillus thiooxidans* and examined the products of metabolism when the bacteria were fed iron and sulfur, the elements that make up pyrite, using surface-sensitive photoelectron spectroscopy and X-ray absorption spectroscopy. Results showed the bacteria produced surface coatings made up of iron sulfate and the iron oxide goethite. Also, different metabolism products formed when both types of bacteria were studied together compared to when only one type was used.

The researchers plan to continue studying the microbes and minerals, starting with simple systems and building complexity by sequentially adding more and different microorganisms. The results may provide insight into other problems, such as tooth decay and metal-pipe corrosion, that arise from the interaction between microbes and the surfaces on which they reside.

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CMCS Introduces Data-Sharing Web Portal

A new online data-sharing Web portal designed to break down barriers to rapid dissemination of validated chemical science information was unveiled at the Supercomputing 2003 conference in Phoenix last November. The project, Collaboratory for Multi-scale Chemical Science (CMCS), resulted from a request by the U.S. Department of Energy's Science Discovery through Advanced Computing (SciDAC) program in 2001 for the development of more collaborative, team-based approaches to science.

"Collaboratories," as defined by SciDAC, link geographically dispersed researchers, data, and tools via high performance networks to enable remote access to facilities, improve access to large datasets and shared environments, and enhance ease of collaboration.

The CMCS portal provides a flexible user interface to a set of collaborative tools that allow users to quickly form teams around complex problems, share and evaluate data regardless of format, discover and use data across physical scales, track the source of data and annotate entries, share analysis tools, and make results available to a wider scientific/industrial community.

The CMCS collaborative team includes researchers from Sandia, Pacific Northwest, Argonne, Lawrence Livermore, and Los Alamos national laboratories, the National Institute of Standards and Technology, Massachusetts Institute of Technology, and the University of California, Berkeley.

Visit the CMCS Web portal at www.cmcs.org.

Water Conservation, Current Technologies Can Ensure Sufficient California Water

A new report released by the Pacific Institute in Oakland, California, claims that up to one-third of California's current urban water use – more than 2.3 million acre-feet – can be saved using existing technology. And more than 2 million acre-feet can be saved for less than the cost to tap into new sources of supply, and without the social, environmental, and economic impacts that any major water project would bring.

Peter H. Gleick, lead author of the report "Waste Not, Want Not: The Potential for Urban Water Conservation in California" and president of the Pacific Institute, claims that the savings can be achieved using "efficient technology, simple changes in policy, and improved public education," while avoiding expensive new water projects that are potentially harmful to the environment.

Researchers at the Pacific Institute looked at well-tested tools such as low-flush toilets, efficient clothes washers, and improved outdoor efficiency. They also examined changes in policy and pricing, public education, and new techniques for all classifications of water users: residential, commercial, institutional, and industrial. The report concludes that saving the water currently wasted in urban areas would ensure a water supply more than sufficient to satisfy the demands of a growing population.

"Saving water is a win for water agencies, a win for our environment, and a win for consumers," noted Dr. Gary H. Wolff, author of the report's economic analysis. "When you account for the other benefits that flow from saving water – like lower energy bills, reduced landscaping costs, and a reduction in waste water – water efficiency measures become very cost-effective, and in some cases are worth doing even if water is free. Our detailed economic analyses show that myths and misunderstandings – not economics – are the biggest barriers to improving our water use efficiency."

The report can be purchased for $32 or downloaded for free from www.pacinst.org/reports/urban_usage.

New Web Site for Sharing Hydrologic Software

The National Science Foundation's Science and Technology Center for Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA) headquartered at the University of Arizona has developed Hydroarchive, a Web site that allows users to share hydrologic software. This software exchange site offers researchers, practitioners, and students the opportunity to make available software they have developed and to benefit from the achievements of others.

The software on Hydroarchive can be downloaded by anyone, free of charge. The Web site also lets software developers make their own code available to the community so that it can be used for research and teaching. Developers have the option to limit commercial applications of their software by defining the specific copyright and terms of use.

Placing software on Hydroarchive is also free of charge, but SAHRA requires that some sort of manual and, preferably, an application example be included in the submission. All software placed on the site must be approved by SAHRA researchers.

Software related to all aspects of hydrology is welcome. Categories currently listed include single- and multi-objective optimization, subsurface (MODFLOW modules) and rainfall-runoff models, sensitivity and uncertainty analysis, and artificial neural networks. At press time, 11 software packages were available.

To access Hydroarchive, visit www.sahra.arizona.edu/software/. For more information, contact Thorsten Wagener at thorsten@sahra.arizona.edu.