Imperial College Seminar

Beyond the Black Box: Integrating Advanced Characterization of Microbial Processes with Subsurface Reactive Transport Models

2010 Darcy lecturer
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Dr Timothy Scheibe will give a seminar on 8th July 2010 in Room 201, Skempton Building, Imperial College London from 4pm. Coffee and tea will be provided from 3.30 onwards.

http://www3.imperial.ac.uk/civilengineering/aboutus/directionsandmaps
[Building 28 on South Kensington campus map]

All welcome – please email andrew.ireson@ic.ac.uk if you plan to attend.

Abstract

As a hydrogeologist with a geological engineering background, my natural focus has often been on physical processes of flow and transport in heterogeneous aquifers. Over the past decade, however, I have been privileged to have had opportunities to work closely with microbiologists on several projects, and my engineer brain has been highly stretched in the process. In fact, I have found myself on many occasions amazed not only by the microscopic world of subsurface microbes (did you know that some can "breathe" metal, or that others can flourish within ionizing radiation fields that would quickly destroy us?), but also by how technically advanced the science of microbiology has become.

The field of environmental microbiology has taken a quantum leap through developments in molecular biology such as high-throughput multiplex sequencing, high-density microarrays, and environmental proteomics; these technologies provide a deluge of information on the nature and function of microbial communities in natural systems. Importantly, many of these systems are relevant to such pressing issues as contaminant remediation and subsurface sequestration of carbon dioxide.

A key question is: How can we use this information to make quantitative predictions in support of environmental management decisions? Microbial processes are typically represented in subsurface reactive transport models based on relatively simple reaction rate models that do not account for known and important complexities of microbial function and community dynamics. While conventional approaches have been very effective in many settings, an opportunity is now being realized to improve the foundational basis of reactive transport model predictions by integrating newly available microbial characterization data and understanding.

In this talk I will introduce the audience to the amazing world of subsurface microorganisms and present some novel approaches for incorporating new knowledge and data into reactive transport simulations. Particular focus will be given to genome-scale models of microbial cell function, and how these models are being integrated into simulations of contaminant transport and fate in groundwater systems. These will be presented in the context of the application of in situ bioremediation that aims to immobilize uranium in groundwater through microbially mediated metal reduction.