

Geomicrobiology

Contributed by Stuart Smith
Monday, 26 February 2007
Last Updated Sunday, 30 March 2008

text and photos copyright 2002-2008 Ground Water Science, use with permission

Geomicrobiology (sometimes the broader term "geobiology" is used) is the interdisciplinary study of the interactions of (micro)organisms and materials in their environments. Geomicrobiology can be viewed as being closely related to (or another term for) microbial ecology and environmental microbiology, and aspects of industrial or applied microbiology - and even astro- or exobiology, but each has a little different emphasis. It is interesting to read discussion of the newly rekindled interest in geobiology and geomicrobiology, as summarized in the December 2001 American Academy of Microbiology (AAM) Report: "Geobiology: Exploring the Interface Between the Biosphere and the Geosphere." This report summarizes the discussions of a colloquium of distinguished scientists held in late 2000 in Tucson, Arizona, and we suggest you download and read it. If you follow the history of microbiology, the science really had its beginnings in geomicrobiology (things found in rain barrels and pipes). This aspect of microbiology was very strong through the early 20th Century, after which, medical/clinical microbiology entirely eclipsed the older subdiscipline, and compartmentalization of knowledge was the order of the day. However, some people have hung on ever since. The definitive textbook on the subject is Geomicrobiology, current 4th ed. 2002, H.L. Ehrlich, Marcel Dekker (pricey, but available from Amazon.com if willing to wait). A journal, Geomicrobiology Journal (Taylor & Francis) has persisted since the late 1980s, and others addressing geobiology and the related discipline of astrobiology are appearing. Recently, a new wave of scholarly interest, fueled largely by climate and environmental issues, rekindled interest in the ecology of disease, and exobiology possibilities in our Solar System (and aided by a renewed spirit of collaboration in science), has resulted in a recent crop of Ph.D.'s and newly established geomicrobiology labs, programs and courses around the U.S. and internationally. Below are some links to some of the more interesting web resources on terrestrial geomicrobiology (there's more going on, but other sites are more about who's there and what they're going to do). Geomicrobiological Processes as Art Just some sightings of interesting geomicrobiological happenings (more as we add them): This is new buzz? We here at Ground Water Science are not new to geomicrobiology, having practiced aspects of it for over 25 years. Stuart Smith (bio elsewhere on our web site), like many now pursuing geomicrobiology, was a kid who never decided whether to 1) look at the rock in the creek, or 2) what grew on the rock, so he does both. While with the National Water Well (now Ground Water) Association, he studied iron related bacteria with O.H. Tuovinen at The Ohio State University. Dr. Tuovinen is a real "geomicrobiologist" from Finland, a hotbed of 1970s geomicrobiology, when it wasn't "cool" yet. Stu later collaborated with him and Laura Tuhela-Reuning (now at Ohio Wesleyan University) on the first modern study (for AWWA Research Foundation) of practical environmental microbiology methods that water plant operators can use to monitor the geomicrobiology of ground water systems - to keep them working! That's our focus and strength - not devoting our professional lives to narrow subjects or chasing research grants, but coordinating information (and collaborative teams) to solve real-life problems. And we're still at it (putting on hardhats and boots and coordinating hydrogeology, microbiology, chemistry, hydraulics, drilling, material performance - and wielding pipe wrenches and multimeters) on projects such as these:

- Multidisciplinary review with recommendations for causes (sedimentary, biogeochemical) of performance problems with a major intermontaine basin wellfield in Colorado.
- Field evaluation of biofouling with electron microscopy and EDS of biologically mediated clogging of an earthen dam drainage system, with recommendations (testing and mitigation studies ongoing).
- Analysis of iron biofouling problems in severely impacted high-capacity pumping and recharge wells for a Great Lakes region utility, including subsurface sampling of aquifer materials for biological activity, development of an innovative rehabilitation plans, and execution of the work.
- Defining geo-bio-chemical and hydraulic causes of well performance (sulfur biofouling + poor well efficiency), done cost-effectively for small village public water systems.
- Conducting test drilling to confirm and characterize the nature of contamination from ethanol spills, the effect on aquifer water quality, and plans for management of the problem for a utility in the Mississippi River Valley, mobilizing multiple skills in a remote (from us) location, and assembling a multidisciplinary team of expertise, including Geoprobe sampling, PLFA analysis and more mundane physical-chemical analysis - well under budget.
- Conducting analyses to define biofouling and biocorrosion mechanisms involved in the rapid corrosion of the casings of multiple monitoring wells, potentially compromising critical data on potential chemical and radiological contamination of ground water - devising and working from a completely self-contained on-site laboratory capability to analyze for microbial contributors to biocorrosion, documentation of evidence of biocorrosion from pulled well components, demonstration of electrical potentials between casings, and definition of a method to measure corrosion potentials between inner and outer casings through grout. Project conducted on a very rapid time scale.

If your facility or project needs information or insight from quality people used to working in a practical, consulting framework (fast, lean, results-oriented), please {In:contact stuart}. We'll lace up our boots and put it together for you. For your edification - some (not all of the) content-rich geomicrobiology-related links:

- Environmental and Geomicrobiology Division Microbial Systems Ecology, Department of Microbiology, Technische Universität München, Germany.
- Geomicrobiology and biogeochemical cycling (University of Texas - Austin Dept of Geosciences)
- Exciting and accessible karst geomicrobiology - University of Texas
- Subsurface Microbiology and Bacteria-Contaminant Interactions - U.S. Geological Survey
- University of Kansas geomicrobiology program Some very interesting mineral-microbe work
- LSU's geomicrobiology & environmental microbiology studies (GEMS)
- Krumholz geomicrobiology lab – University of Oklahoma
- Princeton University geomicrobiology lab – some interesting work
- Deep Biosphere Laboratory - University of Göteborg (visually interesting and informative)
- Center for Applied Geoscience - Geomicrobiology, University of Tuebingen
- www.biogeosciences.org - Geological Society of America

Note: This is a fast-moving field, and additional sources pop up (and sometimes disappear)

frequently. And here at Ground Water Science: More links can be found at our [links](#) page (environmental microbiology, biocorrosion, astrobiology). Also, see other related articles. To make suggested additions or corrections, please contact Stuart Smith.