MICROBES AND MINERALS:
REACTIVITY OF IRON AND MANGANESE BIOMINERALS

MENTOR: OWEN DUCKWORTH

Microbes affect the movement of metals in soils, natural waters, and engineered systems. One way in which microbes influence metal transport is by the production of biominerals, solid phases that are precipitated by and intimately associated with organisms. These biominerals, particularly iron and manganese oxides, strongly absorb potentially toxic metals, such as nickel, zinc, cobalt, arsenic, and tin, thus removing them from the water stream and reducing their mobility in the environment. Because they are such effective scavengers of toxic metals, biominerals may be a component of remediation systems that are utilized for treating contaminated water.

We are working to better understand how biominerals form and bind toxic metals. Specifically, we are working with bacteria that produce iron oxides that form the distinctive rust-colored blooms in creeks, lakes, and springs. In addition, we are also working with manganese oxide producing fungi that were isolated from an environmental remediation system used to treat groundwater at a nearby Superfund site. A better understanding of how these minerals bind metals may lead to better predictive models of metal mobility, improved management strategies, and novel remediation strategies.

Our goals are to (i) determine the rates at which organisms produce iron and manganese minerals, and (ii) determine how the production rate affects the structure and metal binding ability of these oxides. Research will combine microbiology and chemistry, and will include use of cutting edge techniques such as electron microscopy and electrochemistry. In addition to laboratory activities, opportunities may exist to conduct field measurements and collect samples from local waters.