DEPARTMENT OF GEOLOGY
College of Arts & Sciences

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: MARCH 3, 2003

The Geology Department is pleased to offer the following research projects for the summer of 2003. Interested students are urged to contact the faculty member(s) directing the project(s) that most interest them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be, and if possible, develop a timetable for the twelve-week research period.

Improving the Performance of Constructed Wetlands for Treatment of Acid Mine Drainage: Understanding the Clogging of Anoxic Limestone Drains

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Constructed wetlands are widely used in reclamation of both surface and underground coal mines because they are a low-cost, long-term approach to removal of metals and sulfur from discharge water, and one that fits well with the natural landscape. Most such wetlands, however, tend to degrade seriously in their performance over 5 to 10 years. In our previous research, we showed that sulfur and metal removal rates are compromised chiefly by failure to control animals (e.g., beaver) and by failure of the anoxic limestone drains that are used to boost alkalinity of the influent water. Regular trapping can mitigate the animal problem, but it is harder to deal with the frequent failure of the ALDs.

Our earlier work also showed that water exiting the ALDs is at or above saturation with $CaSO_4$. Therefore, we believe that clogging of the drains with minerals such as gypsum is the likely cause of failure. Other possibilities are Fe or Al hydroxides. We propose to excavate a number of failed drains, and study the mineralogy and geochemistry of the material causing the failure using X-ray diffraction, X-ray fluorescence, and potentially electron microprobe. Initial ALDs to be studied will be from wetlands at Tecumseh and at Augusta Lake in SW Indiana. Once the chief culprit in the clogging is determined, we will undertake a series of bench-scale experiments with flow-through columns to investigate the effect of changes in the composition or granulometry of the ALD fill in mitigating the clogging. For example, if calcium sulfate is indeed the culprit as we suspect, use of dolomite rather than limestone may reduce the Ca concentration in the water within the drain sufficiently to prevent sulfate deposition, because the Mg sulfates are much more soluble than Ca sulfates.

Separating and Characterizing Zircons from Metasedimentary Rocks – Learning How Provenance and Depositional Ages Constrain Tectonic Models

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The ages of detrital zircons in clastic sedimentary rocks record information about sedimentary provenance and set maximum ages of sedimentary deposition. In ancient mountain belts, knowledge about the sources and depositional ages of metasedimentary rocks is crucial to tectonic models, but typically this knowledge is only poorly known, or is simply inferred. In the New England Appalachians, such inferences have been proven wrong. The Straits Schist is a regionally extensive and tectonically important tectono-stratigraphic unit of inferred Siluro-Devonian age exposed in western Connecticut and Massachusetts. This project is centered on separating zircon from a 100 kilogram sample of The Straits and characterizing sets of zircon grains with polarized light, cathodoluminnescence, and back-scattered electron microscopy in preparation for U-Pb geochronology.

Research experience: The mentored student will learn how to set up, operate, and maintain a Rogers Table (used to separate minerals from large rock samples); will learn techniques, uses of, and how to perform optical, cathodoluminnescence, and back-scattered electron microscopy; and will learn how to do literature research on a variety of topics.