Dr. John Senko, Assistant Professor in the Department of Geoscience at the University of Akron recently completed a project titled "**Microbial modulation of acidic coal mine drainage chemistry: implications for passive treatment of minewater"** funded by the Ohio Water Resources Center via 104(b) USGS program. Acid mine drainage (AMD) that is produced from abandoned coal mines is one of the most serious water quality problems in the Appalachian coal mining regions of the United States, particularly in eastern and southeastern Ohio. AMD has the potential to cause long stretches of "dead" streams by its high acidity and high iron content. Therefore Dr. Senko investigated the potential of biologically removing dissolved iron from AMD using soil and iron mound bacteria to develop inexpensive, efficient, and sustainable approaches to treating AMD.

Figure 1 Dr. Senko collecting samples from iron mound in the Mushroom farm, Lima, OH

The main goal of this research was to determine how microorganisms associated with formerly pristine soil and AMD develop "iron mounds" that could be exploited for removal of Fe from AMD (Figure 1). The results from laboratory microcosms experiments are quite striking in that they illustrate the rapid rate at which microbial communities associated with pristine soil adapt to intrusion of acid mine drainage, resulting in rapid rates of Fe(II) oxidation (Figure 2). The robust Fe(II) oxidizing activities appear to be attributable to some type of synergistic activities of microorganisms associated with the formerly pristine soil and microorganisms suspended in the AMD that may colonize the soil. We observed that this adaptation is quite rapid, with combined soil- and AMD-associated microorganisms catalyzing Fe(II) oxidation at rates comparable to iron mound sediment after one exchange with fresh AMD. This response appears to be enhanced by the addition of iron mound material (with associated microorganisms).

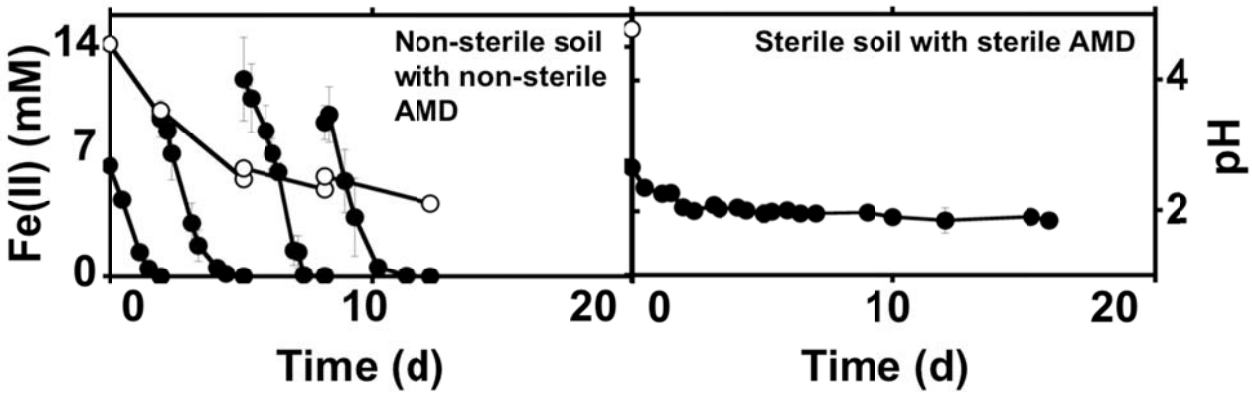

Figure 2 Dissolved Fe(II) (closed circles) and pH (open circles) in two different microcosm incubations including pristine soil and AMD from an AMD-impacted system. These results illustrate 1) that Fe(II) removal from AMD is mostly a biological process, and 2) the development of microbial communities that are capable of rapid and efficient removal of dissolved Fe(II) from AMD.

Researcher: Dr. Senko studies the microbially mediated formation and dissolution of mineral phases and controls on the activities of microorganisms mediating such processes. He is particularly interested in how the ecology, physiology, and in-situ activity of these microorganisms influence migration of environmental contaminants. The major focus of work in his lab is on microbially mediated redox transformations of iron in AMD-impacted systems, and how these activities can be exploited to mitigate the widespread and legacy problem associated with nearly 200 years of coal mining activities in the Appalachian coal-producing regions of the United States.