**WiCCED Undergraduate Internship Description**

Dates of internship: November 1, 2020 – May 7, 2020

Location: University of Delaware, Newark, DE 19711

Faculty Mentor: Donald L. Sparks

Graduate Student Mentor: Joshua Sanchez

Number of positions available: 1

**Title:**

Sea level rise impacts on redox active element mobility in natural systems

**Research Description:**

Sea level rise (SLR) as a result of climate change is affecting the world’s coastlines, especially in the mid-Atlantic region of the US. Impending SLR will change current coastal hydrologic regimes and cause an increase in salinity and flooding, which can lead to major variations in current element cycling. There are numerous redox sensitive elements that will be affected by these impending changes, such as arsenic, nitrogen, or phosphorus. Some metal(loid)s are of particular interest due to their carcinogenic nature as well as their sensitivity to changes in redox potential, which can cause them to become more mobile as redox conditions fluctuate. Currently, there are limited data on the geochemical controls governing redox active metal(loid) cycling in variable saline and brackish water environments. To help address this knowledge gap, redox active metal(loid)s, laboratory synthesized iron oxides, and artificial seawater or river water will be utilized to simulate the effects of flooding and encroaching seawater as a model system. We plan to implement a variety of experiments and techniques to elucidate the cycling and mobility of these metal(loid)s in this newly changing environment. Results from this study will help improve the current understanding of redox sensitive metal(loid) mobility and contribute to management strategies and remediation plans in SLR impacted coastal soils throughout the world.

**Research Questions:**1) What are the independent effects of water chemistry and pH on metal(loid) adsorption to goethite and ferrihydrite (common iron oxides)?

2) How does differing water chemistry (fresh water vs seawater) influence metal(loid) sorption to goethite and ferrihydrite as a function of redox potential?

3) What are the chemical mechanisms governing the release of metal(loid) into solution?

**Student Learning Objectives:**

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| Broad Professional Skills | Specific Skills |
| Express ideas verbally and in writing | Learn how to articulate and communicate your project and results to a diverse audience. Develop a research poster and deliver an impactful presentation. |
| Work independently | Learn to work independently and problem solve. |
| Develop professional attitude and work principles | Ability to be punctual, set goals and meet deadlines, complete assigned tasks, and work efficiently and effectively with others. |

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| Broad Scientific Research Skills | Specific Skills |
| Understand scientific terms | Understand new scientific vocabulary and concepts concerning arsenic and iron redox chemistry and sorption. |
| Literature analysis | Ability to locate, understand, and summarize scientific manuscripts in a manner that will address the current understand and knowledge gaps in the field. |
| Learn and apply scientific techniques | Learn experimental techniques and design methodology to answer specific scientific questions. |
| Use scientific tools and instruments | Gain experience with many tools universally used in wet chemistry, such as pipettes, balances, pH and ORP probes, centrifuges. Will also use inductively coupled plasma mass spectrometer, X-ray diffraction, ultraviolet-visible spectrophotometry, and additional advanced instrumentation. |
| Recognize patterns in research data | Understand characteristic arsenic sorption curves and their meaning |
| Analyze research data | Utilize a variety of software to analyze and interpret data and from effective tables and/or figures. |
| Understand and explain scientific concepts and theories | Effectively communicate your findings at an appropriate level for your audience. Learn to take questions and form responses based on all that has been learned. |

**Prerequisites:**

Looking for a student with a background in introductory chemistry with a strong work ethic and a desire to learn.

**Work Environment:**

Laboratory environment: The lab is located on the 4th floor of the Harker ISE Lab. Hours are flexible and will be determined between student and mentor.

**Stipend:**

$3000

**Funding Source:**

NSF EPSCoR