**DOD-ERDC Summer Internships**

Dates of internship: June 1, 2021 – August 31, 2021

Location: Harker ISE Lab, University of Delaware, Newark, DE 19711

Number of positions available: 1-2

Faculty Mentor: Donald L. Sparks

Professional Staff Mentor: Sunendra R. Joshi

**Project Title:** The effects of salinity and redox oscillation on organic C and its association with other elements (Fe, Al, Ca, and Si) in coastal soils

**Research Description:**

Organic carbon (OC) stabilization via organo-mineral association reduces mobilization of OC in the environment and thus enhances C sequestration in soils and sediments. Hence, organo-mineral association greatly impacts C cycling in the environmental systems and has major implication on the effects of climate change. Coastal areas are increasingly being impacted by flooding, intrusion of salt water, and redox oscillations due to climate alterations. Flooding and rising seas, induced by climate change, can significantly increase salinity that may impact the physical and biogeochemical properties of soils in coastal areas. However, we have limited knowledge about the effect of salinity and redox oscillation on the stability and reactivity of OC associated with other elements. We aim to employ a host of advanced experiments and techniques to elucidate the impacts of salinity and redox oscillation on OC and its association with other elements (Fe, Al, Ca, and Si). Students working on this project would be a component of a multi-institutional project of Department of Defense (DOD) and specific project goals will be formed to cater to students’ interests.

**Research Questions:**How does salinity and redox oscillation impact organo-mineral association and speciation in coastal soils?

1. What is the stability of OC in changing redox conditions under different salinity levels?
2. What types of OC are preferentially sequestered or released from soils in changing redox conditions under different salinity levels?

**Student Learning Objectives: Professional and Research Skills**

This internship focuses on the development of the following professional and scientific skills.

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| Broad Professional Skills | Specific Skills |
| Planning and time management | Ability to set and complete specific goals of varying scope |
| Work independently | Independent work ethic - work independently to problem-solve |
| Collaborative skills | Learning to complete tasks efficiently and effectively with others |
| Express ideas in writing and verbally | Communicate with diverse audiences - Development of impactful poster and oral presentations. Honing ability to deliver scientific results/impacts to people of interdisciplinary background. |
| Broad Scientific Research Skills | **Specific Skills** |
| Understand scientific terms  | Mechanistic and applied concepts regarding C biogeochemistry and redox chemistry |
| Literature analysis | Ability to effectively find and utilize scientific manuscripts related to environmental chemistry |
| Use scientific tools | X-ray absorption spectroscopy, Infrared spectroscopy, scanning electron microscopy, and additional advanced physical and chemical techniques |
| Recognize simple patterns in research data | Applying soil environmental chemistry concepts to qualitative and quantitative data. |
| Apply research tools and techniques in research experiments  | Selective extractions, redox experiments, etc. to investigate organo-mineral relationships. |
| Analyze research data  | Excel, JMP, Origin, and instrument-specific software utilization to form effective figures and tables. |
| Understand, apply, and explain scientific concepts and theories | Freedom to form questions and plan methods for addressing challenges. Learning to effectively communicate results through oral presentations and manuscript writing. |

**Prerequisites:**

Introductory experience with chemistry.

**Work Environment and Expectations:**

Laboratory environment: Harker ISE Lab 4th floor. Hours are flexibly determined between student and mentor. Students will work full time during the summer, June 1 – August 31, 2021. Students will also participate in a retreat, communications workshop, and end of internship spring symposium.

**Stipend:**

$3,500 Direct deposit is required.

**Funding Source:**

**How to apply:** <https://ugresearch.udel.edu/PUB_Program.aspx>