

A UROP perspective by Yuechen Dong

Summer 2023 (undertaken in the Department of Earth Science and Engineering)

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UROP title: Fe²⁺ oxidation reaction in polluted rainwater

I first learned about UROP opportunities for summer 2023 by way of an email from my department. I had also got to know about UROP in general from some of my schoolmates who had already applied successfully for such projects in year 2. Many of them found undertaking a UROP useful. The work they had done involved lab work, machine learning and even having projects that cooperated with a third-party institution. After learning from their experiences, I decided to apply for a UROP in my third year.

Upon the opening of this year's application, I began my search of potential supervisors and research topics by exploring the College website. I read the staffs' profiles and reviewed their published papers to gain a better understanding of their work. Once I had identified several staff whose research areas aligned with my interest, I wrote emails to them hoping to schedule meetings to discuss possible research topics. Sometimes I directly approached potential supervisors by knocking on their doors during their scheduled office hour. Though there were instances when professors were not available during summer, or some already had UROP positions filled by other students, I didn't give up. Finally, I got in touch with Professor Dominik Weiss, whose PhD student, Juy, was working on a research project that welcomed UROP participants. After discussing with the professor and his PhD student, I discovered that in my Dept I would be able to use my UROP project to provide a platform for my MSci project. I knew that I needed to secure some financial support to undertake the UROP during the summer so I applied to both College bursary scheme and the department's bursary scheme. Though I didn't get the College one, fortunately I secured the bursary provided by my department.

Since I was considering applying for a PhD program after my MSci course I think that participating in this UROP project would help me identify my potential research directions for both my MSci project and my future doctoral research more effectively. In particular, during my three years of undergraduate studies, I have developed a strong interest in environmental geochemistry and developed theoretical foundation. However, I haven't had many chances to put this knowledge into practice. I wanted to fill this gap by studying a real-world environmental problem. The project I participated in was related to one of the important environmental issue, that of air pollution.

Before the project started, I discussed the project plan with my supervisor and his PhD student who would also provide support and guidance. In preparation they recommended that I read several relevant articles and textbooks that explain the environmental geochemistry concepts involved in this project. In addition, I reviewed the course material of the environmental report module in year 2 lead by my supervisor. This helped me to refresh my knowledge.

Since my UROP project will provide a platform for my final year MSci project, the work I've done this summer was essentially laying the groundwork for the MSci project. For the first half of my project, I practiced my data analysis skills. This involved performing calculations, creating tables and figures using excel. I needed to collect useful data from previous literatures to compare and contrast them in a single spreadsheet. For the second half of my project, I

learned how to use a software called PHREEQC to analyse chemical species in different solutions. Since this software was completely new to me, everything was hard for me at the beginning. I couldn't run the code appropriately and bugs kept popping up. I reached out to the PhD student who was also supervising me. He taught me patiently about how to debug and gave me useful guidance. After that I started to know the function of each parameter. Finally, I could run a few sets of code successfully and produce meaningful outputs. Throughout the entire project, I also practiced my communication skills. It is important to ask questions, and please be reassured that there are no stupid questions. Only when you ask questions can you know where to improve.

Doing this project has consolidated my thoughts of pursuing a PhD program. It was my pleasure that I was invited by my supervisor to a picnic on a Friday afternoon. Many of the members in his research group were there too. It was such a welcoming group. During the picnic, I talked to the members of the research group, and all the members were very happy to share their experience and current research to me. Through their talking and attitude, I can see that they really enjoy their work. That is the state of mind that I want to pursue in my future work. Before I thought PhD life might be very hard and pressured. But now I think as long as you are doing something you are really interested in, you can be satisfied once you produce your own meaningful result. I know that at my stage the results are not groundbreaking for sure, and it is normal to encounter challenges along the way. The key is to start with achievable goals and gradually build one's expertise as one's gains more experience and confidence. Every project is a stepping stone toward my growth as a researcher and scientist.