Rising atmospheric carbon dioxide (CO_2) concentrations are the main cause of global warming. One option for mitigating high levels of global warming is to capture CO_2 and store it in subsurface rocks. Accelerating carbonate mineral formation in these rocks could provide a long-term carbon storage solution. Kelemen and Matter [1] documented the unexpectedly rapid formation of carbonate veins in a peridotite massif in Oman. The existence of biologically catalyzed carbonate precipitation in other alkaline groundwater systems similar to that of Oman is evidence that the rapid carbonate formation in Oman may be facilitated by microorganisms [2]. I am excited by this area of research because these biological processes could possibly be enhanced to facilitate carbon capture and storage (CCS) [1]. I am interested in completing a PhD in the [Uni A] Geological Sciences Department due to its ongoing research focus on geobiology. My research interests closely overlap with the work of Dr. T.

The two existing *in situ* mineral carbonation CCS pilot projects have injected CO_2 into basalt rocks [3, 4]. Basalts typically have higher porosity than peridotite, but about 75% less olivine, which reacts with CO_2 at the fastest rate and with the most energy released of all common rock-forming minerals. Kelemen and Matter have proposed that billions of tons of CO_2 could be injected and sequestered annually in peridotite if the rock is first heated to 185˚C and fractured at depth [1]. While kinetic models indicate a faster reaction at these conditions, the role of biological activity is ignored. If microbes indeed play an important role in the alteration of olivine, then deep drilling, fracturing and heating could prove counter-productive and unnecessarily expensive. Cost is the biggest roadblock to CCS, so discoveries relating to the geobiology of peridotite-hosted microbial ecosystems that could reduce these costs would spur the development of CCS. For these reasons, I want to research the energy sources of these microbes and their effect on the water chemistry and mineralogy of their surroundings.

I am specifically interested in Dr. T's work on the [project], which is scheduled to break ground in 2015. This project will be the first large -scale scientific drilling project to investigate deep peridotite-hosted ecosystems. In addition to CCS applications, this work is important for astrobiology. Magnesium silicates like peridotite are common in the planets of our solar system, so microbes in Oman peridotite may represent an analog to extraterrestrial subsurface life. I hope to make an impact as a member of the project's team by drawing from my prior research experiences in peridotite and microbial biogeochemistry.

For my senior thesis, I am assessing the potential for carbon capture and storage (CCS) in Staten Island, which contains a partially serpentinized peridotite formation of 40 km^2. To estimate the CO_2 injection capacity of the Staten Island ultramafic body, I am measuring prior mineral alteration through loss on ignition and carbon analysis. In addition, I am gauging the natural rate of mineral carbonation by measuring $^{14}C/^{12}C$ in carbonates, and I am estimating an optimized carbonation rate by determining chemical composition and mineral phases of samples through ICP-OES and XRD.

In addition, I have experience researching biogeochemistry in an unfamiliar field environment. I was awarded a fellowship from the [Uni B Fellowship] to study the effect of sunscreen dissolution on biofilm growth in limestone sinkholes (called *cenotes*) of the Dominican Republic. I became concerned about the effect of dissolved personal care products on the ecosystems of *cenotes* after reading recent studies that showed that dissolved sunscreen harmed coral growth [5]. An ecological reserve in the Dominican Republic allowed swimmers to access some sinkholes, but not others, creating a natural control for the experiment. We were able to observe this in the field, and then replicated these findings in a lab environment. I have also worked on cosmogenic nuclide exposure dating at the [science center]. We used ^{10}Be and ^{26}Al dating to reconstruct the deglaciation history of the Svalbard Barents Sea Ice Sheet (SBSIS). My input involved rock crushing, sieving, acid leachings, froth flotation, and geomorphologic mapping. Our findings should help determine whether the SBSIS contributed significantly to the meltwater pulse 1a, the most rapid period of sea-level rise during the last glacial termination. As a large marine-based ice sheet, the SBSIS is analogous to the modern West Antarctic Ice Sheet, which has been of great concern since its impending collapse will likely cause five meters of sea level rise in centuries to come [6]. I presented preliminary findings at the 2014 fall meeting of the American Geophysical Union.

The precarious West Antarctic Ice Sheet is one of the many reasons why I am motivated to seek practical climate change mitigation solutions. Ultimately, I want to combine my scientific training with economic and political know-how to advance CCS. Prior to studying geology at [Uni B], I studied economics at [Uni C], France’s leading university in the social sciences, in fulfillment of a dual-degree program between the two institutions. I supplemented my academic skills with an understanding of how theory is translated into policy by interning at [Center B], one of the nation's top urban development organizations, located in northern Virginia. Here, I researched for a paper documenting [Center B] County's success in attracting creative people to enhance economic competitiveness [7]. Since the economic feasibility of CCS limits its application, these experiences will help me to convert my scientific findings into action that will benefit society.

My long-term goal is to work as a researcher in a national lab or university, or as a consultant on industrial or governmental CCS initiatives. I intend for my PhD in the Department of Geological Sciences at [Uni A] to serve as a springboard for a career researching and developing CCS. I would be a good fit for [Uni A] due to the overlap between my research interests with those of Dr. T, who is leading research on biogeochemistry of peridotite-hosted ecosystems.

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