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Subduction zones are zones where oceanic crust sinks into the mantle. When the oceanic crust sinks to sufficient depth, dehydration reactions release significant amounts of water. This upward water flux reduces the melting temperature of the overlying mantle. This results in partial melting of the mantle and magmatism. This magmatism, called arc magmatism, is generally hypothesized as the source for much of Earth's continental crust. However, there is significant disagreement over the specifics of this process, particularly in the lower crust.

There are four compositional categories of arc-related mantle-derived magmas. The role of the fractionation of the first three, high-Mg andesitic magmas, tholeiitic basaltic magmas, and calc-alkaline basaltic magmas in the generation of continental crust has been investigated. But, the role of the fourth category, alkaline basaltic magmas, in forming granitic crust in arcs has not been well studied. The alkali-rich chemical composition of the upper crust, however, suggests that alkaline basalts could be an important factor in the development of continental crust.

Claire Bucholz, a graduate student working with Prof. Oliver Jagoutz, has been studying an obducted lower crustal arc complex consisting of depleted mantle, alkali-rich cumulates, and alkali-rich granitoids in the Dariv Ophiolite of Mongolia. (As a magma cools or decompresses, depending on its composition, different minerals will crystallize at different temperatures or pressures. This can result in cumulates, an accumulation of minerals with similar crystallization conditions.) All lithologies are well-exposed and present an excellent opportunity to learn about the fractionation of alkaline magmas in the lower crust of arcs.

The Dariv Ophiolite is located in the Dariv Range which is part of the region-wide Altaid mountains. The Altaids are part of the Central Asian Orogenic Belt (CAOB), a subduction system that lasted for almost 700 My until about 250 Ma. In the CAOB, numerous arcs, ophiolites, and accretionary prisms that were accreted to the Siberian margin are preserved. The Dariv Range is wedged between a magmatic arc called the Lake Terrane and the Zahvan terrane, a proterozoic microcontinent. Besides the ophiolite, the range contains a zone of high temperature metamorphic rock and a zone of slightly metamorphosed sediments and igneous rocks.

This summer, I will be Claire's field assistant working in the Dariv Ophiolite. We will be performing lithological mapping of the region with the goal of creating a general geologic map of the ophiolite and related area. We will also be collecting samples for study upon return. To prepare for this, I will be doing work with the samples Claire collected from the same region last year. Doing this, I will learn about what lithologies to expect while simultaneously assisting with the sample analyses. I will be crushing and powdering rocks for whole rock x-ray fluorescence analyses in order to determine the proportions of various major elements in the rock. I will also be crushing and powdering rocks for LA-ICP-MS, a mass-spectrometry technique that can detect trace elements in the rock. I will also be performing mineral separations in order to determine the oxygen isotope ratios and to extract zircons for U-Pb geochronological dating. The dating will help to constrain the timing of the magmatism in the Dariv Range. Finally, I will be looking at some of the rocks under a microscope in thin section to learn about the lithologic character of the rocks in the Dariv Range.

As an undergraduate studying geology, I find the origin of continental crust to be compelling and I look forward to taking a small part in the research. I also think the field work will be very enjoyable and educational. But, I'd like to get a good sense for what I'm going to be looking at and why while I'm in Mongolia with Claire. I think the lab work will be helpful in achieving that goal and will also be valuable in teaching me some techniques to analyze samples.