Plutonic Lithics Record Variations in the Magmatic System beneath the Akaroa Volcanic Complex, New Zealand

Elizabeth Teeter, 2018

Plutonic lithics from the Cretaceous Akaroa Volcanic Complex (AVC), New Zealand, have textures and compositions that record the dynamic magmatic processes that shaped this volcanic system. The AVC is a multi-vent system with multiple shallow magma bodies above a deep plutonic source (Hampton and Cole, 2009; Hartung, 2011). Plutonic lithics are crystallized rock fragments of the underlying magma chamber that are subsequently incorporated into the erupted materials. Such lithics are essential to understand magmatic processes that occurred in regions, such as the AVC, with limited exposure of the plutonic body.

My research with Professor Rachel Beane of the Earth and Oceanographic Science department focused on plutonic lithics from Paua Bay, New Zealand that I collected during my study abroad semester in New Zealand with Frontiers Abroad. I collected 20 lithics from Paua Bay and had 13 thin sections made. This summer, I focused on 4 of the 13 thin sections. I used Bowdoin's Scanning Electron Microscope to analyze my samples with techniques such as Energy Dispersive Spectrometry (EDS), Cathodoluminescence (CL), and Electron Backscatter Diffraction (EBSD). EDS analysis looks at composition of thin sections, CL imaging shows textures present within samples, and EBSD mapping analyzes crystallographic preferred orientation of minerals.

I used the SEM to create full thin-section maps using all of the techniques of the four lithics I focused on. The lithics showed variation in mineral percentages and textures. The lithics are made up of plagioclase, pyroxene, and ilmenite-spinel. Both CL and EDS imaging show zonation of the plagioclase grains with different amounts of sodium between the core and rim of the grains. Reverse-zoned grains indicate that magmatic recharge events were occurring in the magma chamber that caused the system to go out of equilibrium. Analysis of the Paua Bay plutonic lithics reveals significant variations that may have resulted from dynamic processes within a single magma chamber or from crystallization in magma bodies at different crustal levels.

I will continue this project in an Honors Project with the Earth and Oceanographic department and will continue to analyze the rest of the samples.

Faculty Mentor: Rachel Beane
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References:

Hampton, S. J., & Cole, J. W. (2008). Lyttelton Volcano, Banks Peninsula, New Zealand: Primary volcanic landforms and eruptive centre identification. *Geomorphology*, 104: 284-298.

Hartung, Eva. (2011). *Early magmatism and the formation of a 'Daly Gap' at Akaroa Shield Volcano, New Zealand* (master's thesis).