# Magmatic Evolution Leading Up to the Modern Aleutian Arc on the Alaska Peninsula

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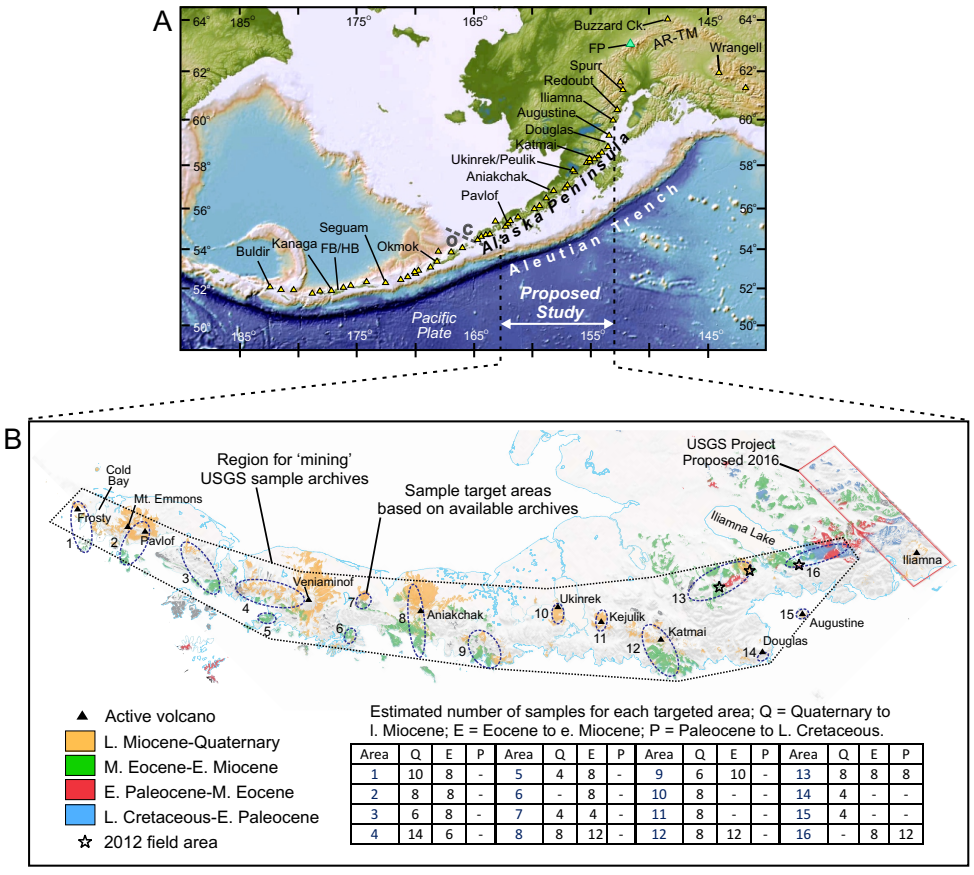
## Project Overview and Relevance to GeoPRISMS Program

The Alaska/Aleutian subduction zone was selected as the highest priority site for the Subduction Cycles and Deformation (SCD) initiative in the NSF GeoPRISMS program. This project, started in May 2015, is a two-year synoptic study that will yield new age and geochemical data on Eocene to Quaternary igneous rocks along the continental segment of the Aleutian arc on the Alaska Peninsula (Fig. 1). The Alaska Peninsula contains over 20 volcanoes with historic activity, five with major eruptions in the past 25 years, and includes Katmai-Novarupta which in 1912 produced the largest eruption of the 20th century. With exposed igneous rocks that span more than 100 million years, the Alaska Peninsula is one of the best places in the world to investigate long-term magmatism and crustal growth along a convergent margin. Yet the Alaska Peninsula is a region where "the availability of isotopic data is poor and insufficient to provide anything beyond the most basic conclusions about geochemical variability in the continental part of the AASZ" (GeoPRISMS, 2013, section 2.2.5). As such, this study aims to capture the inception and growth of the Aleutian arc on the Alaska Peninsula, in concert with the




| Area | Q | E | P | Area | Q | E | P | Area | Q | E | P | Area | Q | E | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 8 | - | 5 | 4 | 8 | - | 9 | 6 | 10 | - | 13 | 8 | 8 | 8 |
| 2 | 8 | 8 | - | 6 | - | 8 | - | 10 | 8 | - | - | 14 | 4 | - | - |
| 3 | 6 | 8 | - | 7 | 4 | 4 | - | 11 | 8 | - | - | 15 | 4 | - | - |
| 4 | 14 | 6 | - | 8 | 8 | 12 | - | 12 | 8 | 12 | - | 16 | - | 8 | 12 |

Figure 1. A) Map of south-central Alaska showing proposed study region on the Alaska Peninsula between Cold Bay and Iliamna volcano, Quaternary volcanoes of the Aleutian and Wrangell arcs (yellow triangles), and selected Eocene igneous rocks (green triangles). FP = Foraker pluton; AR-TM = Alaska Range-northern Talkeetna Mt.ains; FB/HB = Finger Bay and Hidden Bay plutons on Adak Island. Thick gray dashed line shows boundary between oceanic (O) and continental (C) crust. B) Simplified geologic map showing Late Cretaceous through Quaternary igneous rocks in the proposed study region. Blue dashed outlines show the targeted sample areas. The table shows the targeted number of samples in each area for major and trace element analyses.

SCD initiatives to "focus on long-term margin evolution and material transfer" and "the growth and evolution of volcanic arcs and continents" (GeoPRISMS, 2013; section 2.1). Results of this project will contribute to the following fundamental objectives as outlined for the GeoPRISMS program: test for along-arc variations of the Aleutian system, document geochemical products of subduction through time, and evaluate the timing and cause(s) of subduction initiation. Three undergraduate students from Allegheny College are participants in this project.

**Current Status and Forthcoming Work**

To accomplish this regional study, we are using existing samples and data from legacy U.S. Geological Survey mapping projects and recent Alaska Volcano Observatory projects, capitalizing on prior field campaigns. With logistical support from the U.S. Geological Survey, about 250 samples were successfully gathered in May 2015 from the Alaska Geologic Materials Center in Anchorage, covering all of the proposed study areas (Fig. 1). The samples include sets of volcanic and plutonic rocks with a range of mafic to felsic compositions. From these samples, about 200 were cut for thin sections and splits were made for major and trace element analyses. The thin section billets and geochemical splits were sent to commercial labs at the end of June 2015 with thin sections and geochemical data expected by early August 2015. Forthcoming data will include $^{40}Ar/^{39}Ar$ ages, zircon U/Pb ages, zircon Hf-isotopes, and whole-rock Nd-Sr isotopes on subsets of representative samples. We anticipate roughly 80 new radiometric dates and about 40 new isotope samples from this work. The project involves multiple levels of collaboration including: undergraduate institution-research university, academic-government, and an international collaboration. The collaborators include: Dr. Erin Todd (U.S. Geological Survey, Anchorage), Dr. Brian Jicha (University of Wisconsin at Madison), Dr. Jin-Hui Yang (Institute of Geology and Geophysics of the Chinese Academy of Sciences in Beijing), and Dr. Chris Nye (retired, Alaska Volcano Observatory, Fairbanks).