Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23496

Long-lived magmatic systems in the Alaska-Aleutian arc: a tephra perspective

JORDAN LUBBERS, MATT LOEWEN AND KRISTI L WALLACE

U.S. Geological Survey

Presenting Author: jelubber@gmail.com

Long-lived volcanic arcs occasionally produce large volume, caldera forming eruptions. With over 80 Holocene volcanic centers, the Alaska-Aleutian arc provides an excellent opportunity to study the formation of caldera systems, including single edifice calderas (≤ 10 km diameter, e.g., Veniaminof, Okmok, Aniakchak, Semisopochnoi, Kaguyak, Katmai) and multi-edifice calderas (over 10x30 km, e.g., Emmons Lake, Fisher).

Here we present a 1 Ma regional eruptive history from an ocean floor sediment core from International Ocean Discovery Program Cruise 341 in the Gulf of Alaska. This core contains a near-continuous record of over 75 tephra layers from large, tephra-producing eruptions, most likely sourced from the eastern part of the Alaska-Aleutian arc. By comparing matrix glass major- and trace-element geochemistry from core samples to potential source volcanoes, we identify likely source volcanoes for this record.

The majority of eruptions recorded in the Gulf of Alaska match compositions from just two long-lived magmatic systems: Emmons Lake and Katmai. Both have produced VEI 6-7 eruptions since the late Pleistocene (Emmons Lake – C2; Katmai – 23ka) suggesting the presence of mature, geochemically buffered magmatic systems. The two centers have notably different surface morphologies, with Emmons Lake characterized by a large 10x30 km nested caldera system and Katmai a closely spaced region of stratocones with a small caldera and distributed lava domes, and lacking evidence for a regional-scale caldera. Our results demonstrate that: 1) long-lived magmatic systems can produce large-volume eruptions without large calderas; 2) incompatible trace elements in the melt can provide valuable information that not only helps link tephras to their source volcanoes, but also explain the long-term evolution of the magmatic system that created it. Future work linking these findings with ongoing studies of crystal cargo from these systems will help us to better understand arc-scale trends in magma genesis and storage for the Alaska-Aleutian arc.