Geochemical Constraints on Volcano Morphometry in the Aleutian Island Volcanic Arc

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The volcanoes of the Aleutian Volcanic Arc span a wide range of volcano morphometries (sizes and shapes), and it has been demonstrated in the Central American Volcanic Arc, that there is a correlation between geochemical controls on volcano size and shape. If such correlation is found, it may allow the use surface-level morphometric analysis as a proxy for geochemical interpretations. We examine the relationship between subduction parameters, volcano morphometry, and the geochemical signature for a set of eight Aleutian volcanoes. Volcanoes selected for this project lie on the North American continental shelf, off the Alaskan mainland, to reduce the amount of crustal contamination present in the chemical signatures. Analyses used morphometric data produced by Grosse et al. (2014), and open source chemical data available on the Alaska Volcano Observatory (AVO) database. We supplemented to the AVO geochemical data with new results for the Westdahl and Cleveland volcanoes. The analytical procedure performed at LDEO included sample digestion in a HF/ 8 N HNO_3 mixture, continued fluxes of 8 N HNO_3, and culminated in ICP-ES analysis for major elements and ICP-MS analysis for trace elements. Elements selected for morphometric comparison include SiO_2 4.0 for primitive melts, Ba/La as a proxy to dehydration of slab minerals, and Zr/Nb as a proxy for slab sediment breakdown and inclusion. Chemical and morphometric parameters were also plotted against the depths of the subducting slab directly underneath each volcano, using depth measurements reported by Syracuse and Abers (2006). Graphical comparison between geochemistry and volcano morphometry yields weak negative trends that show increasing SiO_2 4.0, Ba/La, and Zr/Nb content with decreases in size. Large standard error in the geochemical analyses prevent the drawing of more concrete conclusions, necessitating more precise chemical analysis to confirm the existences of the weak trends shown here. In addition, we find a complex correlation when directly comparing geochemistry with volcano volume, suggesting that external factors such as slab depth also influence volcano morphometry. Thus, geochemistry alone cannot explain the apparent differences in volcano volume and morphometry.