EGU24-7781
EGU General Assembly 2024

What modulates eruptive styles and timescales at Villarrica and Osorno volcanoes (Chile)?

Sri Budhi Utami[1], Jacqueline Vander Auwera[1], Tonin Bechon[2], Paul Fugmann[1], and Olivier Namur[3]
[1]Department of Geology, University of Liège, Belgium
[2]GEPASUD Laboratory—Campus Outumaoro, University of French Polynesia, Fa'a'ā, Tahiti
[3]Department of Earth and Environmental Sciences, KU Leuven, Belgium

Villarrica and Osorno are two active stratovolcanoes in the Central Southern Volcanic Zone (CSVZ) of the Chilean Andes that share several geochemical characteristics: near-primary, tholeiitic parent magmas (50-53 wt. % SiO_2), overlapping major/trace element differentiation trends, and comparable storage conditions [1-4]. Yet, their current or recent eruptive styles diverge significantly. Villarrica is a steady-state, open-vent volcano with a lava lake that produced ~100 moderate-intensity, Strombolian eruptions since 1579; Osorno is a closed-vent volcano with 10x less eruptions for the same period. Our initial hypothesis proposed that differences in eruptive style and frequency could be due to a relatively higher degree of crustal permeability under Villarrica than Osorno [5]. Although preliminary data shows that some differences exist in olivine chemistry and textures between Villarrica (Fo_{72-87}) and Osorno (Fo_{66-82}) [4,5,6], both volcanoes have broadly similar compositional ranges and multimodal distributions, with comparable diffusion timescales. This suggests the degree of crustal permeability underneath both volcanoes are likely comparable, prompting us to consider other parameters, such as magma supply rate. In this contribution, we discuss and evaluate the role of magma supply rate and other parameters in modulating eruptive styles at Osorno and Villarrica, based on an updated dataset of magma storage conditions, diffusion timescales, and inferences drawn from published literature. We aim to further current understanding of subduction zone magmatism and geodynamics, with implications on volcanic hazard reduction.

1. Vergara et al. (2004). J. S. Am. Earth Sci. 17: 227-238. 2. Morgado et al. (2015). JVGR, 306: 1-16. 3. Pizarro et al. (2019). JVGR. 384: 48-63. 4. Bechon et al. (2022). Lithos. 106777. 5. Utami et al. (2023) Goldschmidt 2023 Abstract 6. Romero et al. (2022). Bull. Volc. 85 (2).