ID de Contribution: **115**

Type: **Poster**

Dynamics of magma reservoir before and after volcanic eruptions at the Axial Volcano in the Eastern Pacific using time-lapse seismic imaging method

jeudi 22 mai 2025 12:00 (15 minutes)

Magma reservoirs (mixture of liquid melt, crystals, and gases) are normally present beneath most active volcanoes from where dikes initiate, and magma erupts to the surface. Depending upon the thermal state of the reservoir, magma may be in a pure melt state if supplied by fresh melt from below, or in a mush state because of cooling by hydrothermal circulation, which increases the crystal fraction in the magma (Singh et al., 1998). The magma is most likely to erupt when it is in a pure melt state, less likely when it is in a mush state. Thus, the nature of the magma reservoir (pure melt versus mush) plays a crucial role in the occurrence of volcanic eruptions and the intensity of the hydrothermal circulation above. Whereas it has been difficult to characterize the nature of magma reservoirs on land due to poor imaging conditions, the marine environment allows more favorable imaging conditions.

The Axial Volcano in the Eastern Pacific Ocean is a large submarine volcano that hosts many hydrothermal vent fields and has erupted three times (1998, 2011 and 2015) in recent years. As a result, it has been the subject of extensive geological and geophysical studies over the last 30 years, including setting up of a permanent, real time, wired-to-shore, multiparameter seafloor observatory (Kelley et al., 2014), and a three-dimensional (3D) multi-channel seismic survey (Arnulf et al., 2019; 2020). Interestingly, 2D seismic reflection data were acquired in 2002, 2012 and 2019 before and after the 2011 and 2015 eruptions, hence these data could be used to characterize the dynamic behavior of magma reservoir before and after the eruptions in a time-lapse sense.

The time-lapse signal could be due to the change in depth of the top of magma reservoir and/or a change in the state (melt versus mush) of the magma. In this study, we apply AVO techniques to monitor the state of a magma reservoir over time, before and after eruptions. We processed three vintages to remove the effect of the data acquisition footprint and to compute the differences between the three data vintages. Key time-lapse 2D seismic processing techniques employed include deghosting, wavelet shaping, amplitude scaling and time shift. To enhance the imaging of AML-reflected waves, we also implement several conventional processing steps such as trace editing, trace interpolation, common midpoint (CMP) sorting, band-pass filtering, predictive deconvolution, normal moveout (NMO) corrections, frequency–wavenumber (f-k) filtering, and stacking. A partial stacking approach is used to assess changes in the magma reservoir across the three seismic vintages.

In the next step, we will perform AVO modeling to compute the P-wave and S-wave reflection responses for various states of the magma lens—ranging from pure melt to fully crystallized magma, in order to better understand the temporal evolution of the magma reservoir and assess its eruption potential as of 2019.

Speaker information

PhD 1st year

Author: ZHAO, Yan (IPGP-TE)

Co-auteurs: Prof. CARTON, Hélène (IPGP); Prof. SINGH, Satish (IPGP)

Orateur: ZHAO, Yan (IPGP-TE)

Classification de Session: Posters

Classification de thématique: Earth, Environment and Space Sciences: Geophysics