

NH53B-1993: Seismic and experimental insights into relative velocity changes at Volcán de Colima in 1998

Friday, 16 December 2016

13:40 - 18:00

📍 Moscone South - Poster Hall

Temporal changes in seismic velocity before eruptions have been measured in a few volcanoes around the world, raising its potential as a forecasting tool. Here we use seismic data from Volcán de Colima, Mexico, to investigate the effect of ascending magma on seismic wave propagation in the edifice. In addition, we use acoustic emissions from laboratory experiments to test the mechanism inferred from the seismic data.

Volcán de Colima entered a new phase of eruptive activity in late 1998 with the extrusion of a new lava dome and flow. A multi-station detection algorithm was used to build a catalogue of 17,893 earthquakes from continuous data recorded by the local seismic network between 1 October 1998 and 1 January 1999. Coda wave interferometry was employed to assess relative seismic velocity change between pairs of repeating earthquakes at each station in the seismic network. First, 1,313 repeating events were identified using waveform correlation, before a stretching technique calculated the relative velocity change of each pair. Linear inversion of these measurements allowed us to retrieve the time history of seismic velocity change within the observation period.

We infer that the variation in seismic velocity resulted from changes in the local stress regime caused by dyke formation during magma ascent. Using acoustic emissions recorded during Brazilian tensile tests on andesite from Volcán de Colima, we demonstrate that a decrease in seismic velocity can be attributed to crack dilation due to tensile stress. This study highlights how a multi-disciplinary approach to understanding geophysical signals can help future interpretations of pre-eruptive activity at volcanoes.

Authors

[Oliver D Lamb *](#)

University of Liverpool

[Silvio De Angelis](#)

University of Liverpool

[Richard Wall](#)

University of Liverpool

[Nick R Varley](#)

Univ Colima

[Gabriel Angel Reyes](#)

[Dávila](#)

Univ Colima

[Raul Arámbula-Mendoza](#)

Univ Colima

[Adrian J Hornby](#)

University of Liverpool

[Jackie Evan Kendrick](#)

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