



The 2012-2014 eruptive cycle of Copahue Volcano, Southern Andes. Magmatic-Hydrothermal system interaction and manifestations.

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Copahue Volcano (COPV), in Southern Andes of Chile, is an andesitic-basaltic stratovolcano, which is located on the western margin of Cavihue Caldera. The COPV have a NE-trending fissure with 9 aligned vents, being El Agrío the main currently active vent, with ca. 400 m in diameter. The COPV is placed into an extensive hydrothermal system which has modulated its recent 2012-2014 eruptive activity, with small phreatic to phreatomagmatic eruptions and isolated weak strombolian episodes and formation of crater lakes inside the main crater. Since 2012, the Southern Andes Volcano Observatory (OVDAS) carried out the real-time monitoring with seismic broadband stations, GPS, infrasound sensors and webcams. In this work, we report pre, sin, and post-eruptive seismic activity of the last two main eruptions (Dec, 2012 and Oct, 2014) both with different seismic precursors and superficial activity, showing the second one a particularly appearance of seismic quiescence episodes preceding explosive activity, as an indicator of interaction between magmatic-hydrothermal systems.

The first episode, in late 2012, was characterized by a low frequency (0.3-0.4 Hz and 1.0-1.5 Hz) continuous tremor which increased gradually from background noise level amplitude to values of reduced displacement (DR), close to 50 cm² at the peak of the eruption, reaching an eruptive column of ~1.5 km height. After few months of recording low energy seismicity, a sequence of low frequency, repetitive and low energy seismic events arose, with a frequency of occurrence up to 300 events/hour. Also, the VLP earthquakes were added to the record probably associated with magma intrusion into a deep magmatic chamber during all stages of eruptive process, joined to the record of VT seismicity during the same period, which is located throughout the Cavihue Caldera area. Both kind of seismic patterns were again recorded in October 2014, being the precursor of the new eruptive cycle at this time as well as the deformation of the volcanic edifice detected by GPS network. In this new eruptive process, the record of tremor was followed by particular seismic quiescence, as precursors of explosive activity which evolved from low acoustic energy signals toward more energetic signals with impulsive first arrivals and strong attenuation, joined to night incandescence in the main vent without evident juvenile material ejected, which could be associated to the temporal depression of the hydrothermal system located in the volcano system. The recent eruptive episode at Copahue Volcano is a good example of the complex temporal evolution of the interaction between magmatic and hydrothermal systems.