Repeating seismic events offer clues about Costa Rican volcanic eruptions

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Repeating seismic events—events that have the same frequency content and waveform shapes—may offer a glimpse at the movement of magma and volcanic gases underneath Turrialba and Poas, two well-known active volcanoes in Costa Rica.

At the 2018 SSA Annual Meeting, Rebecca Salvage of the Observatorio Vulcanologico y Sismologico de Costa Rica presented an analysis of these repeating signals from the volcanoes since July 2016.

When these repeating events are identified at a seismic station, researchers assume that these "events are all produced by a single mechanism and at a similar location at depth ... and by a source which is either non-destructive or able to quickly renew itself," Salvage noted. "Therefore, the identification and an understanding of repeating seismicity may allow us some insight into which parts of the volcanic system at depth are active, and the frequency content of the repeating seismicity may be indicative of processes occurring at depth."

At Turrialba, for instance, Salvage and her colleagues identified a type of repeating event called "drumbeat seismicity," characterized by a very short time interval between events. In January 2017, drumbeat seismicity at the volcano lasted less than three hours but contained hundreds of events. Eight hours later, there was a small eruption at Turrialba. In this case, the drumbeat seismicity may have been a "precursor signal" of the eruption, related to magma moving toward the surface, Salvage said.

"However, not all eruptions are preceded by these types of earthquakes, and often these earthquakes occur with no identifiable eruptive activity," she added. "A better understanding of drumbeats in terms of the conditions under which they do occur, and statistical analysis on inter-event times and occurrence rates will allow us to better assess whether these can actually be used as a warning tool."

At Poas, the researchers noted another interesting halt in six families of repeating seismic events, just two hours after a swarm of magnitude 2.7 and higher earthquakes was recorded very near the volcano. In this case, Salvage and her colleagues think that the earthquakes may have influenced the stress field around the volcano in a way that halted the repeating events. The stress field may have changed when the earthquakes generated small displacements on local faults that created similar small diversions in magmatic gas and ash rising to the surface.

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