

***Turrialba Volcano (Costa Rica): Opening of a new fumarolic vent
on the southeast flank of the West Crater on January 12th, 2012***



Decompressional opening event at the southeastern flank of the West Crater with fine lithic material emission on January 12th, 2012 (photo: Sergio Guillén Víquez)

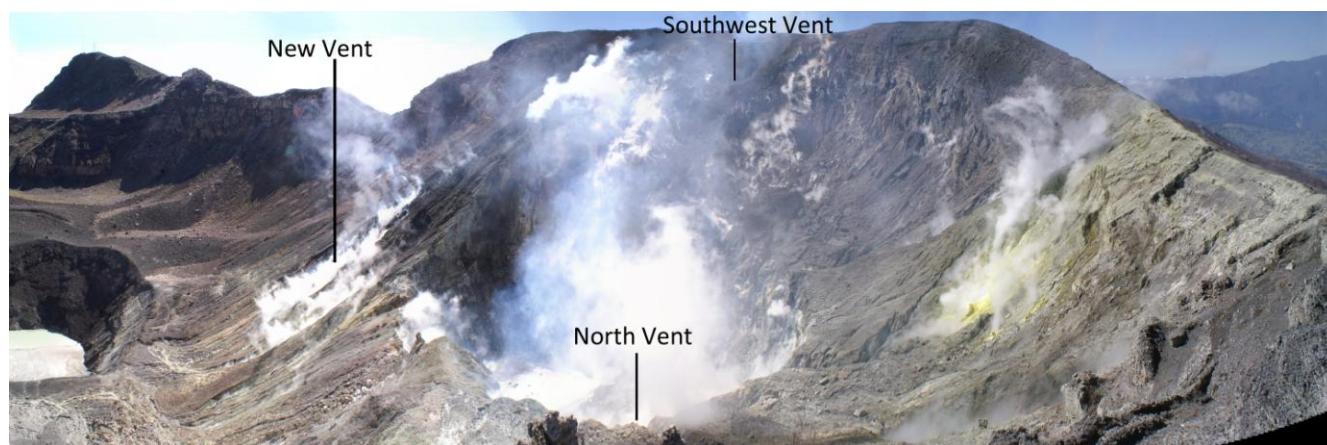
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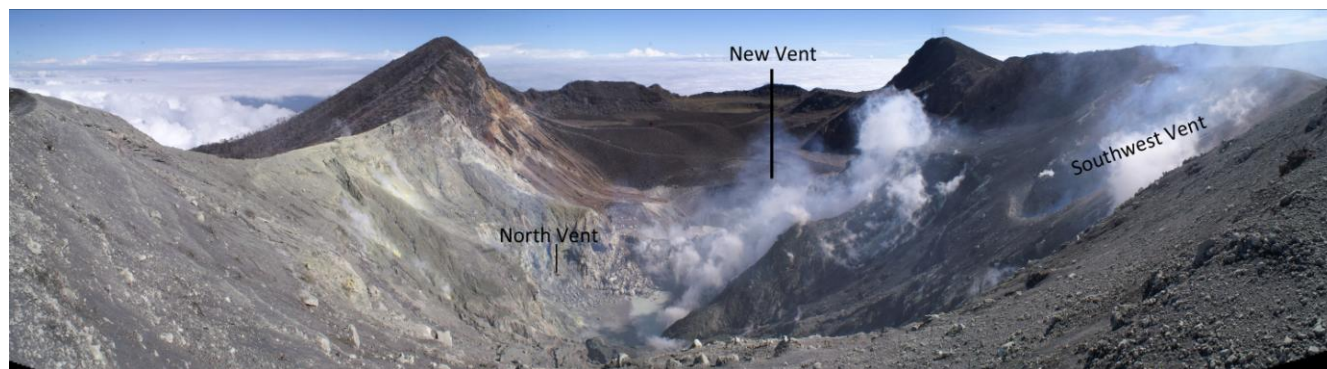
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Observations:

- On January 12th, 2012, the opening of a new vent on the southeastern flank of the West Crater triggered an ash emission that travelled mainly north-northeast with the wind (however ash fall was reported at Tres Ríos, 27 km southwest of the volcano). A strong jet of high temperature ($\sim 592^{\circ}\text{C}$) gas followed. The emitted ash is not the product of new magmatic material but lithics blown off from the conduit that opened up during the sudden decompression.
- This new vent is small sized ($\sim 3 \times 5\text{m}$) in regard with the Southwest vent that formed on January 5th, 2010 ash eruption. On January 13th, 2012, no more ash emission was occurring but a vigorous output of bluish gas at high temperature ($T > 592^{\circ}\text{C}$) that generated a jet-like sound audible from the visitor lookout.
- No unusual seismic activity and deformation was noticed associated to this fumarolic decompressional event. However, CO_2 flux measurements in the affected area decreased by up to an order of magnitude between January 11th and 13th, 2012. The ground temperature at 10cm depth had also increased to $\sim 90^{\circ}\text{C}$ (boiling temperature of the water at this elevation).



View of the West Crater (in front) from its northern rim and the Central Crater (to the left)



View from the western rim of the West Crater. In the background the Central and East craters of Turrialba volcano (photos: Geoffroy Avaré, OVSICORI-UNA)

Interpretation:

Ten years of intense hydrothermal activity with vigorous fumaroles mainly within the West Crater of Turrialba volcano, combined with high rainfall in this region have contributed to heavy leaching of the crater-wall rock. Rock leaching caused by the magmatic-hydrothermal fluids contributes to rock rot, decreasing the rock resistance and therefore increasing the unstability of the crater walls, thus aiding degradation and erosional processes and the formation of crevices. Turrialba volcano has entered a passive but strong degassing phase of activity since 2007, with the emission of an important quantity of magmatic gas and water vapor into the atmosphere. However, part of the hot volatiles accumulate underground generating an increase of ground temperature, internal pressure, fumarolic activity and the accumulation of mineral phases stable at the typical temperature of hydrothermal systems such as sulphur, anhydrite, alunite which can act as fumarolic conduit seals.

The observations from both, the OVSICORI-UNA 24h before and after the opening of the vent and the National Park Rangers on the January 12th, 2012, brought us to the following conclusion. A gradual shallow accumulation of hot volatiles in the ground triggered the increase of both the fumarolic activity and the temperature of the ground. It also triggered the deposition of some stable mineral phases such as high viscosity sulphur on the southeast flank of the West Crater as noticed by the personnel of Turrialba Volcano National Park and the OVSICORI-UNA since mid-December 2011. The accumulation of volatiles and heat in this sector of the West Crater built an overpressure in the east flank until rupture on January 12th, 2012, when the fracturing of the rocks allowed a sudden decompression of the area through the newly formed fumarolic vent. Fragments up to 1x0.5m were ejected with the ash, but no juvenile material was emitted during the opening event. Hence, the January 12th, 2012, “eruption” does not correspond to either phreatic or magmatic activity; it is a sudden decompression process through a weak rocky area of the southeast flank of the West Crater, which was severely altered by the magmatic-hydrothermal activity and atmospheric weathering.

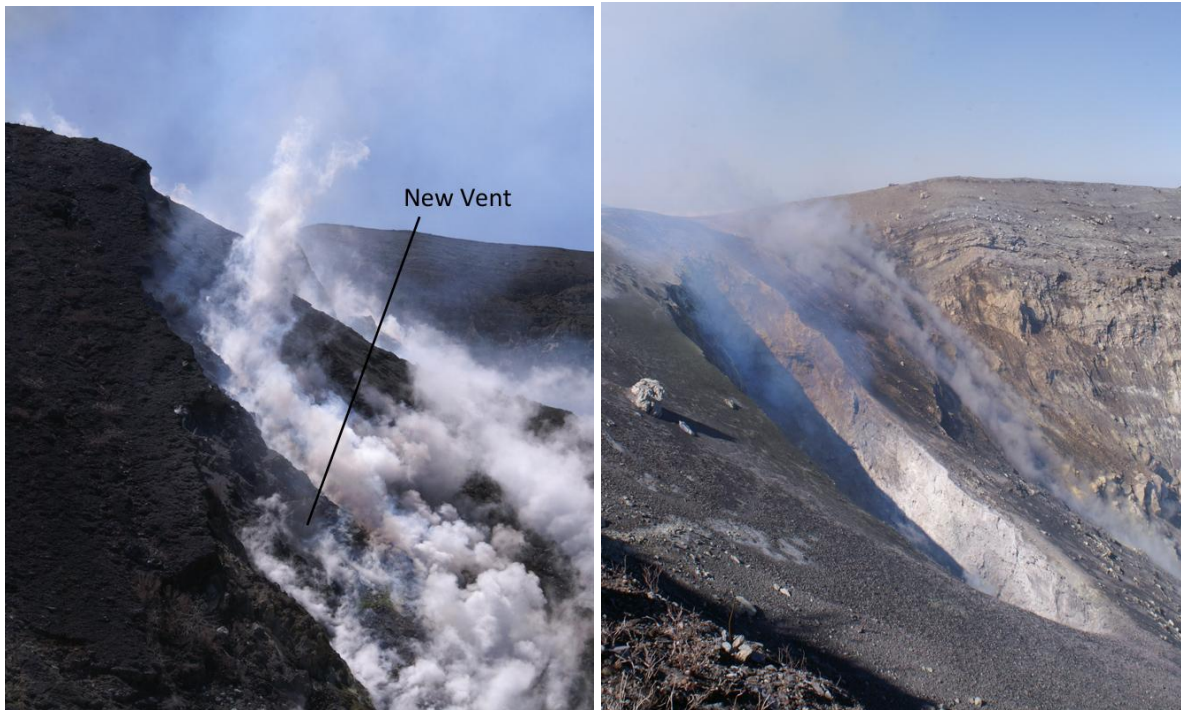
Conclusions:

On January 5th, 2010, the reported ash fall was the consequence of the opening of a vent on the southwest flank of the West Crater, although small at that time became much bigger due to erosional processes. In 2011, another small vent opened on the north flank of the West Crater, most likely during the rainy season, which did not allow any clear observation. The new vent that appeared on the southeast flank of the West Crater on January 12th, 2012, is small sized compared to the southwest vent but is likely to widen with erosion.

The participation in the overall degassing output of these two new small vents and of the fumaroles spread in the whole crater is minor in comparison to that of the southwest vent. The latter vent still canalizes the main part of the gas and aerosols that form the vigorous volcanic plume, which is frequently visible from the Central Valley on clear days.

The stories on the 1864-66 eruption of Turrialba volcano mention the formation of numerous similar fumarolic vents prior to the phreatic and phreatomagmatic eruptions (*Peraldo and Mora, 2008*). More recently, Irazú volcano started its activity by the opening of tens of high-pressure fumarolic vents before erupting in 1963.

Up to now at least 3 high pressure and high temperature vents can be identified on Turrialba volcano (refer to the associated video on the webpage of the OVSICORI: <http://www.ovsicori.una.ac.cr/videos/Turrialba-2012-01-13.mp4>). Considering the continuous degassing process, the weakening of the crater wall-rock and the high rainfall rates in the region, we can expect an increasing number of vents in the future and a widening of the existing ones.



Comparison between the new vent (3x5m) that opened on January 12th, 2012, and the southwest vent (~60x20m) that opened on January 5th, 2010 (photos: Geoffroy Avard, OVSICORI-UNA)

To summarize, even if the decompression event that occurred on January 12th, 2012, is part of the normal activity of Turrialba volcano, and the volcano is not yet showing signs of imminent eruption within a short time, it is important to keep in mind that it remains highly active with the potential of endangerment related to its volcanic activity. We can anticipate the formation of other vents similar to the southwest, north and east vents in a short and medium time scale for the same reasons, which will generate ash emission and ballistic blocs that justify fast preventive reactions and preparations such as the ones developed by the Turrialba Volcano National Park's administration, and by the National Commission of Emergency, CNE, on January 12th, 2012.

Bibliography:

Giovanni Peraldo y Mauricio Mora, Enseñanzas de la actividad histórica de los volcanes Irazú y Turrialba, Costa Rica, América Central, en: Historia y Desastres en América Latina, Volumen III, ed. Virginia García Acosta, Publicaciones Casa Chata, 2008.