

Not My Fault: The tragedy of Goma

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Posted June 6, 2021

<https://www.times-standard.com/2021/06/06/lori-dengler-the-tragedy-of-goma/>

On May 22nd Mount Nyiragongo in the Democratic Republic of the Congo (DRC) erupted. Lava flowed towards the city of Goma, nine miles to the south. Goma, a city of 670,000 people, is located on the north shore of Lake Kivu and adjacent to the Rwanda border. Not all of the details are completely clear, but the current damage tally is 32 deaths, 1000 homes destroyed, and nearly 500,000 people displaced.

This is not the first time Nyiragongo has threatened Goma. In 2002, lava flows penetrated through the city and flowing to the shore of Lake Kivu, destroying 25-75% of the city, and burying 10,000 homes. Between 100 to 245 people died, due to gas asphyxiation, lava flows, or collapsing structures.

Mount Nyiragongo is near the middle of the African continent, far from plate boundaries. What causes the volcanic activity? Perhaps, like Hawaii, a hotspot? Except it isn't the only active volcano in Africa. Erta Ale Volcano, 1300 miles to the north in Ethiopia, is also erupting right now. NOAA's NCEI volcano database lists 138 potentially active volcanoes on the continent and 18 eruptions since 1900.

Most of Africa's volcanic centers lie between Tanzania and Ethiopia. But it's not a straight line; the volcanic centers bifurcate at the northern end of Lake Malawi. An eastern zone, including Mount Kilimanjaro, crosses through Kenya and a western zone crosses Burundi and along the border between the DRC and Rwanda.

Africa's modern volcanism is the result of a continent in transition. All continents are transitory features. For at least a half of our planet's existence, earth's outer surface has been reshaping itself with continental masses colliding to form supercontinents and then breaking apart into small ones. The plate motion is driven by the heat within the earth and the differential gravitational pull on heavier and lighter materials.

Continental rocks don't conduct heat as well as the much thinner oceanic crust. As a result, continents trap and

concentrate heat flowing from deeper parts of the earth like a thick blanket. The heat eventually causes the plate to bulge and stretch. As the plate thins, fissures form allowing vents for hydrothermal and volcanic activity. The most spectacular manifestation of this process is Africa's Great Rift Valley.

In Africa, we are witnessing the birth of a new plate boundary. Extensional stresses from the thinning crust aren't uniform. The result is a number of fissures and tears oriented roughly north south. The rifting began in the Afar region of northern Ethiopia around 30 million years ago and has slowly propagated to the south at a rate of a few inches per year and has now reached Mozambique. In the coming millennia, the rifts will continue to grow, eventually splitting Ethiopia, Kenya, Tanzania and much of Mozambique into a new small continent, much like how Madagascar began to be detached from the main African continent roughly 160 million years ago.

What we don't know is which of the many rifts zones in East Africa will eventually win out and form the new plate boundary as a new African ocean slowly grows. It's anyone's bet whether eastern rift through Kenya and Tanzania or the western zone along the Rwanda – Congo border will become the final border. But for now, the result is wide zones of earthquake and volcanic activity along both rift segments.

Mount Nyiragongo is the most active volcano in the western rift zone. Every few years it produces a few radial fissures with basaltic lava fountains and flows, usually confined to the lightly populated tropical forest and farmland surrounding it. But at least twice in the past century, eruptions have been larger, impacting Goma and the nearby populated towns and villages.

The volcanic threat to Goma is well known and the DRC established a volcano observatory in 1986 funded by the World Bank to monitor seismic and volcanic activity. In September 2020, scientists at the observatory noticed the lava lake at the summit was rapidly filling and reported an eruption likely within months to years. Unfortunately, the World Bank had cut off funding after corruption allegations and internet connections, data collection and staffing had all been disrupted.

The first indication of last month's eruption was lava erupting from the flank of the volcano and flowing towards Goma. The DRC ordered people to evacuate. Evacuation was chaotic, with some reports attributing traffic accidents as a major contributor to the casualty toll. Many of the evacuees fled to neighboring Rwanda. As I write, volcanic

activity has slowed, and the lava flows stalled outside the city limits. Evacuees are returning home but infrastructure including roads and water lines disrupted.

All disasters occur with a political, economic and cultural context and nowhere is this illustrated more clearly than in the Congo. In 2002, it was the Second Congo War between Rwanda and the DRC. Hostile military forces from Rwanda were occupying Goma at the time. When many people evacuated into Rwanda, they permanently lost their homes.

In 2021, politics are still an issue. Although a peace agreement was signed in 2002 and the relationship between Rwanda and the DRC has improved in the past two years, tensions remain. Violence continues in many parts of the country with rebels in control of some areas. The ongoing rebellion has hampered the country's ability to respond to the COVID crisis and has made response planning for natural disasters a low priority.

Perhaps the greatest tragedy of Goma is that deaths in both 2002 and 2021 were preventable. The relatively fluid lava produced by Mount Nyiragongo doesn't pose the explosive threat of many other volcanoes and modern monitoring techniques are capable of alerting populations. Scientists can map volcanic hazards and zoning could protect the most vulnerable areas. Evacuation planning, drills and education could limit the hazards of chaotic fleeing from the city. But these are the luxuries of richer nations and, alas, unlikely to change anytime soon.

Note: Learn more about Africa's rifting the recent Mount Nyiragongo eruption at

<https://theconversation.com/africa-is-splitting-in-two-here-is-why-94056> and

<https://theconversation.com/mount-nyiragongos-volcano-why-its-unique-and-treacherous-161847>

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