

Volcán de Colima Volcanology Internship

Report for the Old Centralians' Trust

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A small eruption of Volcán de Colima.

I'm grateful to have had the opportunity to spend time in Colima in August 2024, where I joined a small team researching and monitoring Volcán de Colima, Mexico's most active volcano. It was an incredibly interesting experience – academically, allowing me to learn and develop numerous skills: from data collection in the field, to understanding technical instruments, to picking seismic traces; as well as bringing to my attention many of the obstacles inhibiting research and continuous monitoring of the volcano.

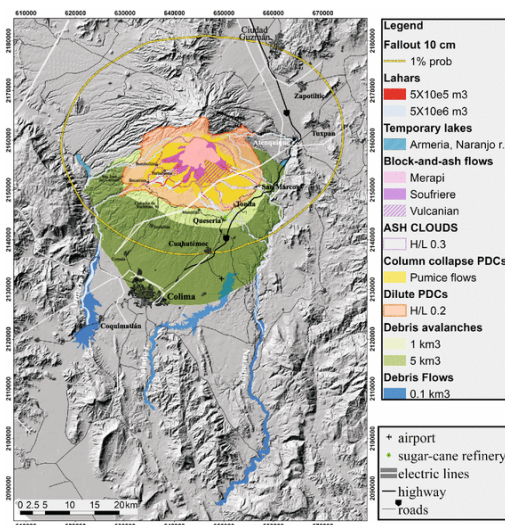
A trans-continental bus journey is a good way to start any trip. I was already on the other side of the Atlantic, and to my mind was already exceeding my annual quota of air miles getting there and back, and so the only logical way of upholding any semblance of environmental integrity was by making the journey from Canada to Mexico by coach.

It didn't take long to question my decision-making. The first bus was delayed, causing me to miss the subsequent seven. The next five days were an adventure, if nothing else, full of interesting characters and gritty US bus stations. It was a relief to cross the border into Mexico, with the caveat that the bus didn't stop at said border (supposedly one of the highest-security borders in the world), leaving my passport unstamped and my presence in the country very much unauthorised.

I eventually stumbled off the final coach when it arrived in Colima, everything whirring from my whistlestop tour of North America. I was met by Nick, the eccentric volcanologist who runs the lab and the exchange program (Colima Intercambio e Investigación en Vulcanología, CIIV), who gave me a lift to the local house-share where I was to live for the next several weeks.

The next morning, I walked over to the university to meet the other volunteer interns currently working with Nick: Mieke, Charlie and Kristin, as well as Marco, Nick's only part-time employee. The volcanology lab was a chaos of shelves stacked with boxes and a handful of desks, half of which were covered with rocks and various other equipment. The disorganisation was somewhat comforting to me, as were the smiling people. I liked it.

So began my time in Colima. I found a free desk, claimed a fan (essential to survival), and slowly got to grips with the many facets of work going on in the lab. We rarely saw Nick, who was spread so thin that his presence in the lab was always fleeting. We as volunteers had little supervision or direction – I was taught about the workings of the lab and its various instruments primarily by the others, who had been there barely a few weeks, and instructions written by past volunteers. It was an exciting combination of independent and collaborative work, but the many obstacles to the continuous monitoring of the volcano were evident.



Left: The ash plume of an eruption of Volcán de Colima, viewed from Colima town centre. Right: A hazard map for Volcán de Colima, with the city of Colima within the 'danger zone' for debris avalanches.

Volcán de Colima is an active stratovolcano that is part of the trans-Mexican volcanic arc, formed by the subduction of the Cocos plate beneath the North American plate. It has been frequently active in the past several decades, prompting periodic evacuations of nearby villages. Activity is characterised by lava extrusion and occasional larger explosions, which can cause pyroclastic flows and significant ash clouds. The volcano is currently in a period of quiescence, having experienced no eruptions since 2017. However, the history of large, destructive eruptions of Volcán de Colima further back in time, causing debris flows travelling over 100 km, and its proximity to significant population centres including the city of Colima (~300,000 people live within 30 km of the volcano), make it a highly dangerous volcano. Its danger is such that it warrants a position on the list of 'Decade volcanoes', 16 volcanoes in the world singled out for study due to their potential to cause significant damage and loss of life.

In spite of this, and the very real implications of the work for the local population, research and monitoring of Volcán de Colima is hindered by a severe lack of funding, something that quickly became clear upon arriving there. For me, it was an insight into the interplay of academic research with socio-economic issues, something that is prevalent worldwide,

particularly when it comes to the management of natural hazards. Developing countries are often at an increased risk of significant destruction as a result of geohazards such as volcanoes and earthquakes, owing to a lack of resources and funding for better preparations and infrastructure. Working there, this was evident day-to-day and only compensated by motivation and belief in the work being done. There is a lack of time and manpower – Nick, without the funds to hire anyone full-time, is torn teaching, researching, and managing volunteers and their work himself. Broken equipment was unable to be fixed or maintained, and these factors, combined with political problems, mean a high frequency of fieldwork and data collection is not possible. Even so, data is slow to be processed, resulting in years of backlog, and in reality, little in the way of real-time monitoring, at least during this quiet period.



Fieldwork taking SO₂ measurements of the volcano (seen in the distance in the left photo). A direct, cloudless view of the summit is required, so conditions here were sub-optimal. Right: setting up instruments (ScanDOAS and 'SO₂ camera', which have different ways of measuring SO₂).

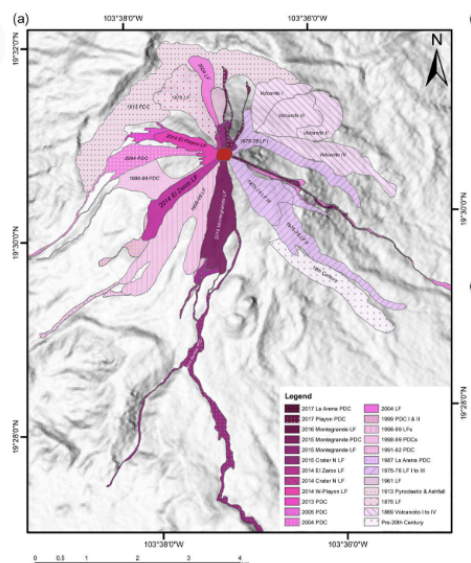
While I was there, the rainy season was in full swing. We left the lab most afternoons straight into a downpour, complete with some spectacular shows of thunder and lightning. This provided a further reason for the limited fieldwork opportunities. We grasped at any chance we got, however, and did manage to get out on occasion, to take water samples from springs for geochemical analysis (which can be indicative of volcanic activity), and to take SO₂ measurements of the volcano, to see if there is any active degassing (in reality, the main goal in this instance was to work out if the instruments were working).



Spring sample collection. Left: The rainy trek to the site at the base of the volcano, which is hidden behind the clouds. Right: Collecting water samples from the spring (muddy puddle, at first appearance). We measured temperature and pH in-situ, and sent samples for chemical analysis.

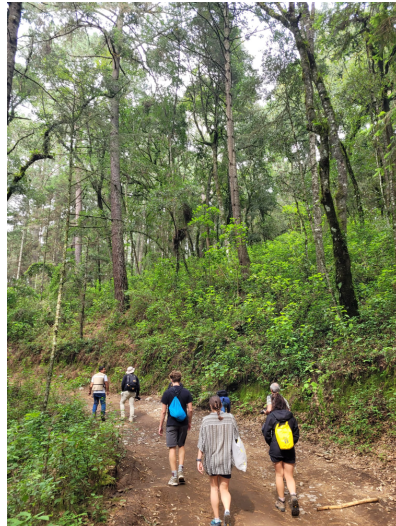
In addition to fieldwork and carrying out day-to-day instrument and equipment testing and maintenance, I worked on some other projects while in Colima. My independent project involved beginning work to conduct granulometric analysis of PDC (pyroclastic density current) deposits from a major 2015 eruption, to understand more about its unique eruption and transport mechanisms. While I didn't have the time to see the project all the way through to interpreting the results, I made a start on calculating various grain-size statistics for the hundreds of samples.

I also assisted with working through seismic data to record and classify volcano-generated seismic events. This will hopefully ultimately lead to a better understanding of the volcano's patterns of behaviour and possible eruption precursors.



Left: A map of lava flows (LF) and pyroclastic density current (PDC) deposits on the slopes of the volcano. The PDC deposit that extends all the way to the south of the map (in dark purple) is the one I studied, in an attempt to discern the nature of the eruption and why this PDC travelled so far. Right: The lab.

When we weren't in the lab, we managed to do some exploring of this rich region of Mexico. My first weekend was spent at 'La Feria del Hongo' – a mushroom festival – in a remote village in the mountains, where we camped and ate our way round a huge variety of mushroom-themed Mexican dishes. In contrast, another weekend was spent in the seaside resort town of Manzanillo.



A weekend at 'La feria del hongo'. Left: an array of mushrooms that can be found in this mountainous region. Centre: A walk through the forest. Right: One of the many delicacies we tried: huge, hand-sized mushrooms, grilled with cheese.

An unfortunate family situation sadly cut my time in Colima short of the planned two months, but it remains an incredibly influential experience which allowed me to develop a host of academic skills, as well as show me some of the realities of research and geohazard mitigation. I'd like to express my enormous thanks to the Old Centralians' Trust for their financial support which made this internship possible, allowing me to play a part in this crucial research effort.



Sunset on the beach in Manzanillo.