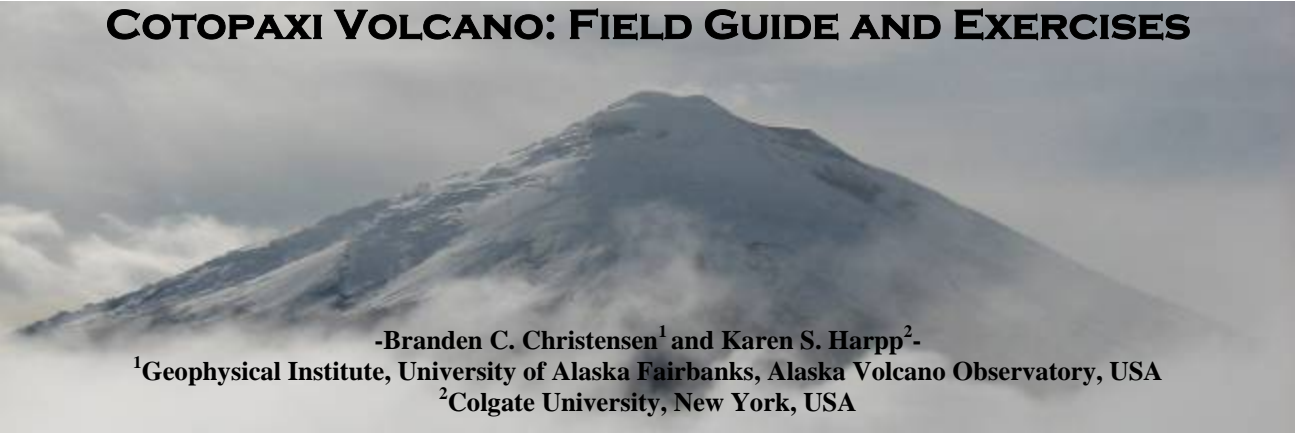


COTOPAXI VOLCANO: FIELD GUIDE AND EXERCISES



-Branden C. Christensen¹ and Karen S. Harpp²-

¹Geophysical Institute, University of Alaska Fairbanks, Alaska Volcano Observatory, USA

²Colgate University, New York, USA

THE LOGISTICS:

Getting there: Cotopaxi can be reached by heading south from Quito along the Pan-American Highway. Turn left at signs advertising the entrance to Cotopaxi National Park (1.5 hrs from Quito). The actual park entrance is located a considerable distance from the PanAm (at least a 45 minute drive). You must enter the park to access the deposits described here.

Entering the park: To enter the park you must (1) pass through the park entrance before 4 pm; and (2) be accompanied by an official guide; (3) have the passports of each member of your group in hand and ready for review. No exceptions are made. If you fail to arrange for a guide or arrive later than 4 pm, you will be refused entrance to the park even if you have reservations to stay at Tambopaxi (a resort located deep within the park). The park entrance fee is 10 USD per person.

Housing: There is only one place to stay within the park: Tambopaxi Hosteria. See below for more details.

SUGGESTED STOPS AND FIELD EXERCISES:

Call Quarry

UTM (07)690/(99)223, 3110m

Once you turn off the Panamerican Highway, keep your eyes peeled for Callo Quarry on the right hand side of the road (within a few kilometers of the highway- there is no sign). Stop here briefly to speak with the owner in Spanish. Explain to him that you are visiting Cotopaxi with a group of geologists who are keen on studying the volcano and that tomorrow on your way out of the park you would like to look at the deposits within the quarry. In the past, the owner has welcomed students into the quarry.



Proceed onward towards the park entrance. The remainder of this guide concerns stops within the boundaries of the national park.

Quebrada Agualongo

Location: West flank of Cotopaxi

UTM: (07)769/(99)285; 3530m

This outcrop lies adjacent to the road that snakes through Cotopaxi National Park and after the park entrance. It can be difficult to locate if you have not done some



reconnaissance ahead of time. A sequence of ashfall and secondary lahar deposits rise four to five meters on each side of a small (and usually dry) brook. This is a Class A outcrop and contains a snapshot of the last 1500 years of eruptive activity at Cotopaxi. We recommend using your time here to have students develop detailed stratigraphic sections. After the students have gotten their hands dirty, have them draft a list of the hazards on the basis of the deposits. Take out a hazard map and do an overview discussion

further down the road where you will have a perspective of the volcano and its surroundings (barring bad weather).



Additional information about Quebrada Agualongo including a stratigraphic section can be found on pages 22 and 25 (Figures 21-23) of the Cotopaxi field guide seen to the left and available on our website. An annotated video of the quarry is available for viewing on YouTube at:

http://www.youtube.com/watch?v=0IYI_Wh7IDI

The lahar plains at Limpiopongo

After passing through the park entrance, you will travel up and around the western flank of Cotopaxi volcano. Prior to reaching the lahar plains at Limpiopongo you will see a craggy mountain rise up on your left (Rumiñahui volcano) and the Yanasacha lava flow on the right (UTM-(07)814/(99)312; 3870m). If you have a clear day, you will be able to see Sinchilagua volcano straight ahead and the summit of Cotopaxi to your right. Just past this 15m thick andesitic lava flow are the lahar plains at Limpiopongo. Signs for Limpiopongo will direct you to the left. Stay your present course, pulling off the road just past the lava flow.



To reach a pyroclastic flow deposit with beautiful levees hike SE straight across the lahar plains from the final toe of the Yanasacha lava flow toward Cotopaxi. After fifteen minutes you will come to an aqueduct four feet in width. Make your way across this and

then skirt to the left of the hills (other lava flows) in front of you (the ones dotted with stubby trees). The pyroclastic flow of interest came down the prominent gorge which can be seen to your left, then smashed into the highest of the hills dotted in stubby trees and fizzled out at the break in slope. Climb to the top of the leftmost hill to get a bird's eye view of the flow. Allow for half an hour in each direction. I have posted a video on YouTube that will aid you, be it slightly, in orienting yourself. It was taken from the lahar plain at Limpiopongo: <http://www.youtube.com/watch?v=3xY3Qb9C4Js>.



Tambopaxi Hosteria

UTM (07)845/(99)353, 3720m

<http://www.tambopaxi.com/>

(593-99) 448-223

Once you have reached the lahar plains at Limpiopongo the signs will direct you to Tambopaxi. We recommend staying here 1-2 nights. The owners are amiable and the service is great. The bunks are arranged in dormitory style, each room fitting six to ten warm bodies. If you do not reserve the entire place, then you will probably be staying with a handful of climbers who will be heading out later that night to climb Cotopaxi. Because it is a climber's refuge, lights go out at 9 p.m. and any kind of ruckus thereafter is not tolerated. There is a white canvas for presentations. Bring your own computer and projector if you want to have a lecture in the evening. Anyone planning to stay overnight at Tambopaxi soon after arriving in Quito may not sleep well because of the elevation.

(photo adopted from <http://www.tambopaxi.com/>)

Refugio

Most medium size tour busses can make the ascent to the refugio's parking lot with minimal jockeying. The change in elevation between the parking lot and the refugio is 300 m (1000'). The refugio is located at 4,800 m (16,000') so the going will be slow, given the altitude. Allow from between 30 and 90 minutes for most people to reach the refugio. Anyone who is exposed to the elements at this elevation **MUST** wear sunscreen, sunglasses, and prepare for cold rainy weather. In thirty minutes time at 16,000 feet on the equator you can do heaps of damage to your retinas and get the sunburn of your lifetime.



SUGGESTED PEER-REVIEWED LITERATURE:

Eruptive History

Barberi, F., Coltelli, M., Frullani, A., Rosi, M., Almeida, E. (1995). Chronology and dispersal characteristics of recently (last 5000 years) erupted tephra of Cotopaxi (Ecuador): implications for long-term eruptive forecasting. *Journal of Volcanology and Geothermal Research* 69: 217–239.

Seismology and Geophysics

Molina, I., Kumagai, H., García-Aristizabal, A., Nakano, M., Mothes, P. (2008). Source process of very-long-period events accompanying long-period signals at Cotopaxi Volcano, Ecuador. *Journal of Volcanology Geothermal Research* 176: 119–133.

Hazards

Mothes, P., Hall, M., Janda, R. (1998). The enormous Chillos valley lahar: an ash-flow generated debris flow from Cotopaxi volcano, Ecuador. *Bulletin of Volcanology* 59: 233–244.

Mothes, P., Hall, M.L., Andrade, D., Samaniego, P., Pierson, T.C., Ruiz, A.G., Yepes, H. (2004). Character, stratigraphy and magnitude of Historical lahars of Cotopaxi volcano (Ecuador). *Acta Vulcanológica* 16: 85–108.

Petrology and Geochemistry

Hall, M. and Mothes, P. (2007). The rhyolitic-andesitic eruptive history of Cotopaxi Volcano, Ecuador. *Bulletin of Volcanology* 70: 675–702. doi: 10.1007/s00445-007-0161 2.

For a comprehensive list of Cotopaxi publications see the website.