



Volcanic debris avalanches in Costa Rica, Central America

G. E. Alvarado

Sismología y Vulcanología, ICE, Apdo. 10032-1000, Costa Rica; Escuela de Geología, Universidad de Costa Rica

Volcanoes in Costa Rica have yielded numerous sectors and flank collapses during Pleistocene and Holocene epochs. The geological record provides evidence for at least 17 of these volcanic events in the last 1 Myr. One historical small volume debris avalanche occurred in 2000 AD but from an inactive volcanic range. Volcanic debris avalanches and associated formation of “avalanche calderas” have occurred at roughly one per 5000-6000 yr, although during the Late Pleistocene the recurrence period in some volcanoes could be as small as one event every 2000-4000 yr. Large-scale edifice failure occurs at Costa Rican volcanoes ranging from 1 to 127 km², volume up to 8.2 km³ in size, and have an apparent coefficient of friction (H/L) between 0.06 and 0.17; the maximum runout distance was of 23.5 km. Large slope failures were a significant degradational process at Costa Rican volcanic ranges in >20 km³. These depressions often show an orientation reflecting the tectonic regime of active faults. Most of the volcanic failures probably were generated by flank spreading and/or earthquakes. I am also investigating evidence for magmatic intrusion as a trigger. The best studied volcanoes, as Miravalles, Irazú and Turrialba, presented three or more sector collapses in the past 17 ka, alternating with growth phases. In addition to hazards from the avalanches themselves, landslides near large artificial reservoir as Arenal could produce tsunamis, or as in the past, debris avalanches could be transformed into lahars. As one detailed case of study, I examined the volcano stability at Arenal, using geological mapping and sampling combined with mineralogic, petrologic, and geotechnical lab studies in addition to finite element analysis.