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Volcanism and associated hazards: the Andean perspective

R. I. Tilling
Scientist Emeritus, Volcano Hazards Team, US Geological Survey, Menlo Park, California 94025-3591, USA

Abstract. Andean volcanism occurs within the Andean Volcanic Arc (AVA), which is the product of subduction of the Nazca Plate and Antarctica Plates beneath the South America Plate. The AVA is Earth's longest but discontinuous continental-margin volcanic arc, which consists of four distinct segments: Northern Volcanic Zone, Central Volcanic Zone, Southern Volcanic Zone, and Austral Volcanic Zone. These segments are separated by volcanically inactive gaps that are inferred to indicate regions where the dips of the subducting plates are too shallow to favor the magma generation needed to sustain volcanism. The Andes host more volcanoes that have been active during the Holocene (past 10 000 years) than any other volcanic region in the world, as well as giant caldera systems that have produced 6 of the 47 largest explosive eruptions (so-called "super eruptions") recognized worldwide that have occurred from the Ordovician to the Pleistocene.

The Andean region's most powerful historical explosive eruption occurred in 1600 at Huaynaputina Volcano (Peru). The impacts of this event, whose eruptive volume exceeded 11 km^3, were widespread, with distal ashfall reported at distances >1000 km away. Despite the huge size of the Huaynaputina eruption, human fatalities from hazardous processes (pyroclastic flows, ashfalls, volcanogenic earthquakes, and lahars) were comparatively small owing to the low population density at the time. In contrast, lahars generated by a much smaller eruption (<0.05 km^3) in 1985 of Nevado del Ruiz (Colombia) killed about 25 000 people – the worst volcanic disaster in the Andean region as well as the second worst in the world in the 20th century. The Ruiz tragedy has been attributed largely to ineffective communications of hazards information and indecisiveness by government officials, rather than any major deficiencies in scientific data. Ruiz's disastrous outcome, however, together with responses to subsequent hazardous eruptions in Chile, Colombia, Ecuador, and Peru has spurred significant improvements in reducing volcano risk in the Andean region. But much remains to be done.

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