

Sucesive desestabilization of a dome complex constructed on an extinct, hydrothermally altered volcano: The Tutupaca Volcano case study (Southern Perú)

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The Tutupaca volcanic complex (17°01' S, 70°21' W) is located to the south of Peru, and belongs to the Central volcanic Zone of the Andes. Tutupaca is composed of an old, hydrothermally altered and highly eroded basal edifice, and two younger twin peaks, located to the northern part of the complex (the Western and Eastern Tutupaca; Samaniego et al., 2015). The youngest Eastern edifice of Tutupaca is composed by at least 7 coalescing lava domes (named Dome I to VII by Manrique, 2013) and its associated deposits, among which are block-and-ash flow and debris avalanche deposits. We identified two debris avalanche deposits associated with this edifice. An older deposit (Azufre debris avalanche) was channelized in the valleys located to the E and SE of the volcano, reaching up to 3.5 km from its source region. This DAD occurred soon after the emplacement of the first Eastern Tutupaca domes (I, II, III) and its age was recently estimated by exposure dating at 6-8 ka BP. The younger deposit (Paipatja debris avalanche) outcrops immediately to the NE of the amphitheater and was associated with a large PDC deposits that was radiocarbon dated at 218 ± 14 a BP (Samaniego et al., 2015; Valderrama et al., 2016). Both debris avalanche deposits have two different sub-units: (1) the main subunit, hereafter called hydrothermal-altered blocks-rich debris avalanche deposit (HA-DAD) that is a whitish-yellow volcanic breccia with heterolithological and heterometric blocks, and (2) dome-rich debris avalanche (DR-DAD) sub unit, composed by non-altered dome blocks. In proximal areas, the DR-DAD overlaps the HA-DAD; whereas, in distal areas, these two units are mixed forming a hummocky and/or ridged topography.

In addition to the similar facies of these DAD, we propose that the triggering mechanism for these debris avalanches was similar in both cases. The ascent of a dacitic magma, coupled with the fact that the Tutupaca dome complex was constructed on top of an older, hydrothermally-altered volcanic edifice, induced the destabilisation of the edifices, producing the debris avalanche and its related pyroclastic density currents.

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