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# Causes and consequences of bimodal grain-size distribution of tephra fall deposited during the August 2006 Tungurahua eruption (Ecuador)

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## Abstract

The violent August 16–17, 2006 Tungurahua eruption in Ecuador witnessed the emplacement of numerous scoria flows and the deposition of a widespread tephra layer west of the volcano. We assess the size of the eruption by determining a bulk tephra volume in the range 42–57 × $10^6$ $m^3$, which supports a Volcanic Explosivity Index 3 event, consistent with calculated column height of 16–18 km above the vent and making it the strongest eruptive phase since the volcano's magmatic reactivation in 1999. Isopachs west of the volcano are sub-bilobate in shape, while sieve and laser diffraction grain-size analyses of tephra samples reveal strongly bimodal distributions. Based on a new grain-size deconvolution algorithm and extended sampling area, we propose here a mechanism to account for the bimodal grain-size distribution. The deconvolution procedure allows us to identify two particle subpopulations in the deposit with distinct characteristics that indicate dissimilar transport-depositional processes. The log-normal coarse-grained subpopulation is typical of particles transported downwind by the main volcanic plume. The positively skewed, fine-grained subpopulation in the tephra fall layer shares close similarities with the elutriated co-pyroclastic flow ash cloud layers preserved on top of the scoria flow deposits. The area with the higher fine particle content in the tephra layer coincides with the downwind prolongation of the pyroclastic flow deposits. These results indicate that the bimodal distribution of grain size in the Tungurahua fall deposit results from synchronous deposition of lapilli from the main plume and fine ash elutriated from scoria flows emplaced on the western flank of the volcano. Our study also reveals that inappropriate grain-size data processing may produce misleading determination of eruptive type.

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