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Mass budget partitioning during explosive eruptions: insights from the 2006 paroxysm of Tungurahua volcano, Ecuador

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How and how much the mass of juvenile magma is split between vent-derived tephra, ballistic, PDC deposits and lavas (i.e. the mass partition) is related to eruption dynamics and style. Estimating such mass partitioning budgets may reveal important for hazard evaluation purposes. We calculated the volume of each product emplaced during the August 2006 paroxysmal eruption of Tungurahua volcano (Ecuador) and converted it into masses using high-resolution grainsize, componentry and density data. This dataset is one of the first complete descriptions of mass partitioning associated with a VEI 3 andesitic event. The scoria fall deposit, near-vent agglutinate and lava flow include 28, 16 and 12 wt. % of the erupted juvenile mass, respectively. Much (44 wt. %) of the juvenile material fed Pyroclastic Density Currents (i.e dense flows, dilute surges and co-PDC plumes), highlighting that tephra fall deposits do not depict adequately the size and fragmentation processes of moderate PDC-forming event. The main parameters controlling the mass partitioning are the type of magmatic fragmentation, conditions of magma ascent, and crater area topography. Comparisons of our dataset with other PDC-forming eruptions of different style and magma composition suggest that moderate andesitic eruptions are more prone to produce PDCs, in proportions, than any other eruption type. This finding may be explained by the relatively low magmatic fragmentation efficiency of moderate andesitic eruptions. These mass partitioning data reveal important trends that may be critical for hazard assessment, notably at frequently active andesitic edifices.