Unsteady and steady phases of the Kaharoa 1314 eruption, Tarawera volcano, New Zealand

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The 5 km3 Kaharoa eruption of AD1314 was a prolonged rhyolitic eruption (ca. 5 years) involving at least 7 source vents located along an 8 km long fissure transecting a pre existing dome complex. Following vent opening explosions, seven early powerful pyroclastic fall phases formed tephra lobes dispersed to the SE with minor pyroclastic explosive activity. The eruption deposits have characteristics typical of both subplinian-Plinian (absolute intensity, duration) and Vulcanian styles (multiple explosive phases, dense juvenile clasts, grain size fluctuations). These characteristics are not compatible with end-member models of either rapid ascent (Plinian), or short lived, low intensity (Vulcanian) explosions. Each pumice fall unit is separated by partings rich in fine ash, interpreted to represent short quiescence intervals between eruptive phases. Within fall units, grainsize and juvenile clast density measurements taken on a bed by bed basis provide a high-resolution eruption chronology that implies the degree of "steadiness" (or instantaneous mass discharge rates) of the eruptive phases.Two fallout units were chosen to represent "unsteady" and "steady" eruption conditions. We use clast microtextures combined and analytical measurements to evaluate the parameters that drive steady vs. unsteady silicic explosive eruptions. Initial microtextural observations reveal that the partial outgassing of the magma column in the conduit was a critical factor in driving unsteady eruptions. Additionally, high density (greater than 1600 kgm-3) juvenile clasts increase in size and abundance during unsteady phases suggesting evacuation of stagnant melt within the conduit, plug or dome. Our juvenile clast density analysis also shows evidence for the existence of a protodome or plug in the active vent at an earlier stage of the eruption than initially postulated.