The ~4-ka Rungwe Pumice (South-Western Tanzania): a wind-still Plinian eruption

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Abstract

The ~4-ka trachytic Rungwe Pumice (RP) deposit from Rungwe Volcano in South-Western Tanzania is the first Plinian-style deposit from an African volcano to be closely documented focusing on its physical characterization. The RP is a mostly massive fall deposit with an inversely graded base. Empirical models suggest a maximum eruption column height H_T of 30.5–35 km with an associated peak mass discharge rate of $2.8–4.8 \times 10^8$ kg/s. Analytical calculations result in H_T values of 33 ± 4 km (inversion of TEPHRA2 model on grain size data) corresponding to mass discharge ranging from 2.3 to 6.0×10^8 kg/s. Lake-core data allow extrapolation of the deposit thinning trend far beyond onland exposures. Empirical fitting of thickness data yields volume estimates between 3.2 and 5.8 km^3 (corresponding to an erupted mass of $1.1–2.0 \times 10^{12}$ kg), whereas analytical derivation yields an erupted mass of 1.1×10^{12} kg (inversion of TEPHRA2 model). Modelling and dispersal maps are consistent with nearly no-wind conditions during the eruption. The plume corner is estimated to have been ca. 11–12 km from the vent. After an opening phase with gradually increasing intensity, a high discharge rate was maintained throughout the eruption, without fountain collapse as is evidenced by a lack of pyroclastic density current deposits.

Keywords

RungweTanzaniaPlinian eruptionsPhysical characterizationEruptive parametersWind-free conditionsTrachyte