

Eruption Dynamics of the KS1 caldera eruption of Ksudach Volcano, Russia

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The 240 A.D. KS1 eruption of Ksudach volcano, which dispersed ash across most of the Kamchatkan peninsula, resulted in a 6-7-km³ caldera. Prior work showed the deposit consists of 15 km³ of tephra falls and 3-4 km³ of pyroclastic flows. New details reveal the eruptive dynamics of the eruption. A sharp change from white to gray pumices and ash in the upper part of the deposit defines a distinctive timeline. Proximally, KS1 deposits consist of a white pumice fall deposit with interbedded ash layers, followed by thick, white pyroclastic flow deposits with interspersed thin falls, which are overlain by gray fall and flow deposits. Medial and distal sites consist mainly of pumice falls and thin ash layers. Pumices in many of those fall layers are coated with ash, and the ash layers contain abundant pumices. At all sites, the lowermost fall layer is reversely graded. The lithic content of the white pumice falls increases upward until the uppermost fall is dominantly lithics. The gray fall layer contains fewer lithics. We interpret the changing deposits with distance and height to reflect differences in simultaneous deposition from buoyant (fall) and non-buoyant (pyroclastic flow) parts of an eruption column. Early on, most material came from a buoyant plume, whereas later in the white pumice phase of the eruption material from the non-buoyant part of the plume increased in abundance. A buoyant plume again became important during dispersal of gray pumice. The dispersal of lithics in the fall deposits reveals that the buoyant plume increased in height from the base to the middle of the white falls, when production of pyroclastic flows also increased, and then decreased to the white-gray shift and gray pumice deposition. The combination of a greater column height for the middle white fall and greater production of pyroclastic flows shows that the total mass flux of the eruption peaked during that stage of the eruption and waned afterward.